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No. 11.

FIRST ANNUAL REPORT

OF THE

HARBOR AND LAND COMMISSIONERS,

FOR THE YEAR

1879.

BOSTON:

Band, Aberg, & Co., Printers to the Commonwealth,

117 FRANKLIN STREET.

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Commonwealth of Massachusetts.

HARBOR AND LAND COMMISSIONERS' REPORT.

To the Honorable the Senate and the House of Representatives of the Commonwealth of Massachusetts.

THE Board of Harbor and Land Commissioners, in accordance with the provisions of law, respectfully submit their Annual Report for the year 1879.

The Board were appointed under chap. 263 of the Acts of 1879, and entered upon their duties the first day of July, succeeding to the work heretofore in charge of the separate Boards of Harbor Commissioners and Land Commissioners.

This report presents the result of the work of the entire year so far as practicable.

SOUTH BOSTON FLATS.

By this name is known the large area of flats belonging to the Commonwealth beyond the riparian line of the north shore of South Boston, extending from Fort Point Channel to Castle Island, and including some 750 acres.

Prior to 1869 the southerly bound of the Commonwealth's property adjoining the property of the Boston Wharf Company had not been adjusted; but in that year it was definitely settled. The line to which filling could be extended had also been then determined. And in that year a sale of what is now known as the 25-acre piece was made to the Hartford and Erie Railroad for the sum of \$545,505, or fifty cents per foot. At the close of that year a further sale of about 50 acres, next easterly of the 25-acre piece, was also sold to the Boston and Albany Railroad at twenty cents per

foot. For the purchase by the Hartford and Erie Railroad, a note secured by mortgage was taken; and by agreement the Boston and Albany was to pay for its land on the first day of October, 1872, either in cash, or in its bonds bearing six per cent interest, payable semi-annually, and agreed, "unless, for good cause shown," to build a substantial sea-wall upon the northerly side of its purchase, and to complete the whole filling of the 50-acre lot on the first day of October, 1875.

In December, 1871, the Hartford and Erie Railroad having failed to comply with the conditions of its mortgage, and not having paid its note, the land sold to it in 1869 was purchased at a mortgagee's sale by the Treasurer in behalf of the Commonwealth.

In 1873 the Boston and Albany Railroad, having neither paid the money for its purchase, nor even commenced the work of filling and walling, alleging "good cause" therefor, a new contract was made with that corporation by the Commonwealth. By this contract the time for filling was extended to Oct. 1, 1876, at which date the purchase-money was to be paid, and the whole work completed; and no interest was to be charged from Oct. 1, 1872, to Oct. 1, 1876, in consideration of the stipulations and agreements contained in this supplementary contract, and in the four-part contract of the same date between the Boston and Albany Railroad, the Boston Wharf Company, the city of Boston, and the Commonwealth; and by these contracts the Commonwealth agreed to fill and wall the 25-acre piece, and to do certain other things. [The contracts of 1869 and 1873 may be found in House Doc. of 1878, No. 21.]

Prior to the formation of this Board, the Land Commissioners had demanded from the Boston and Albany Railroad the purchase-money due in October, 1876, and had collected in April, 1878, the sum of three hundred and thirty thousand dollars on account. After that date there had been much correspondence, which may be found in House Doc. 21 of 1878, and in the Second Report (1879) of the Land Commissioners; but, when this Board was organized, no settlement had been made.

The early attention of this Board was given to this subject: but as a proposition had been made by the New York and New England Railroad to purchase the 50-acre lot from

the Boston and Albany Railroad, and to assume some of, or all, the obligations of the Boston and Albany to the Commonwealth, and negotiations were pending between these parties, a settlement of the matter was delayed by request of the Boston and Albany Railroad; and it was not until late in September that active negotiations were commenced between the New York and New England Railroad and this Board. At first the proposition by that corporation was to purchase a portion of the 25-acre piece, to alter the plan for filling the 50-acre piece, to construct the Northern-avenue Bridge, and to extend the time of the lease. While this proposition was under consideration, another proposition was made by the New York and New England Railroad,—to settle all the claims of the State against the Boston and Albany Railroad, to purchase the 12-acre piece and the 25-acre piece, and to build the Northern-avenue Bridge for its own use, by a promise of the New York and New England Railroad to pay to the Commonwealth at some future and undetermined date the sum of five hundred thousand dollars, which should remain at two per cent interest for five years, at three per cent interest for the next five years, and at four per cent interest for the next five years, “and as much longer as the Commonwealth may choose to let the debt run;” no deed of the land to be given until the five hundred thousand dollars with accrued interest were fully paid: but a full release was to be given to the Boston and Albany Railroad.

As the claim of the Commonwealth against the Boston and Albany Railroad, exclusive of any claim for damages, and the cost of material already placed in the 12-acre lot at the low contract price of the Boston and Albany Railroad, would amount to about a hundred and fifty thousand dollars,—leaving for the 12-acre piece partially filled, and for the 25-acre piece filled and walled at a cost to the State of nearly a million of dollars, only three hundred and fifty thousand dollars, or about twenty-one and a half cents per foot,—the proposition was declined.

Subsequently it was proposed to have the price fixed by two gentlemen, both named by the corporation: but this proposition was also declined, because, if the price proposed to be paid was approximate to the estimate by the New

York and New England Railroad of the value of the land, it was clear to the Board that the time for sale had not arrived; and, besides, there was land contiguous to the State's land, held by private parties, which could be purchased by the corporation, if it so desired.

It was suggested, that, because the State owned some stock in the New York and New England Railroad, that corporation should be treated more liberally than other parties; but this was not assented to by the Commissioners, who failed to see why a round sum should be allowed, one-sixth of which, if the Commonwealth were at liberty at any time to sell its stock, and so avail of any benefits received by the corporation, would go to the State, while five-sixths would go to the other owners of the stock, provided the property of the corporation shall in the future exceed its bonded debt. If not, the whole gift would be to the bondholders.

But there is another and even a stronger reason why the Board could not consent to sell any of these lands, either to this railroad or to any other party, at a price below their real value; which is, that they are pledged as security to the holders of Massachusetts scrip.

When the State, already burdened by the use of her credit for the cost of the war and the Hoosac Tunnel, was compelled to borrow still more money for these purposes, she, by solemn enactment of law, pledged these lands to the payment of the war loan and the Hoosac Tunnel loan. These loans are not yet fully paid; and, until they shall be, this Board does not consider it any part of its duty as agents of the State in the first place to assent, and then to ask the consent of the Governor and Council, to any disposition of these lands, by which the proceeds of the pledged securities of the State shall be diminished, and the good faith of the State violated.

During the negotiations of this Board with the New York and New England Railroad, it became evident that it was hopeless to wait any longer for a settlement to be made between that corporation and the Boston and Albany Railroad; and that, in order to secure an earlier completion of the work upon the 50-acre lot, and its occupancy for business purposes, it was necessary for this Board to settle the outstanding account between the State and the Boston and Albany

Railroad without delay. To secure such result, a communication was at once sent to the Boston and Albany Railroad, asking for a prompt settlement of the account. Since then the various items thereof have been examined and discussed; and it is expected, that, in a very short time, the amount due from that corporation, except what is due for damages caused by its delay, will be paid into the treasury of the State. It is obvious that the whole amount of damage caused by this delay cannot be computed until the delay ceases.

With the approval of the Governor and Council, a contract (a copy of which is annexed) was made with Boynton Brothers for the filling of B Street; and a portion of the work has been done.

In addition to the flats already described, the State purchased of the riparian proprietors, under chap. 446 of 1869, all the flat between B and E Streets, except the interest of two parties (as fully described in the First Report of the Land Commissioners), for the sum of \$243,091.41.

The expenditures upon the South Boston Flats, as given in the Second Annual Report of the Land Commissioners (December, 1878), were \$1,004,237 28

In 1879 there have been expended, —

By Land Commissioners	22,637 02
Governor and Council (Clapp & Ballou)	81,202 73
Harbor and Land Commissioners	2,846 01
	<hr/>
	\$1,110,923 04
The Boston and Albany has paid on account . \$330,000	
The New York and New England Railroad	
has paid for rent	6,500
	<hr/>
	336,500 00
	<hr/>
Leaving	\$774,423 04

as the net cost to the State, exclusive of interest.

The 25-acre piece is the only land filled and now ready for occupancy. Had the Boston and Albany Railroad completed the filling of the 50-acre piece, as it agreed to do, the 25-acre piece would now have been accessible, of present value, and ready for sale, because a bridge would have already connected it with the city proper. Under the supposition that this bridge would speedily be built, there have been applications for the property from both purchasers and

lessees, — the purchasers at a price per foot above the average cost, and the lessees at rates much beyond the price now paid by the New York and New England Railroad. But, until some arrangement can be made to secure the North-avenue Bridge, the property is inaccessible, except by water, or by a circuitous route over land belonging to another party. The rental now paid by the New York and New England Railroad is ridiculously low for so valuable a piece of property, and the continuance of the present lease can be justified, if at all, only because the State cannot now guarantee to any purchaser or lessee free access to the property, except by water. Whenever deemed advisable, the present lease can be terminated by a twelve months' notice.

At present the New York and New England Railroad is the only railroad which connects with the property at South Boston, and is, apparently to the public, the only purchaser; but other parties with large capital have already notified this Board of their desire to make arrangements for the occupancy of these flats.

And here this Board would proceed to call your attention to the connection of these flats with existing railroads, were it not, that, by the action of the last legislature, that subject was referred to a special commission, consisting of the Board of Railroad Commissioners and this Board.

But, in considering the value of this property, it is well to remember that the present terminal facilities which can be used for shipping freight received from the West, owned or controlled by the Boston and Albany, the Fitchburg, and the Lowell Railroads, below bridges, and exclusive of South Boston, are less than 50 acres in all: while in Baltimore two railroads use over 200 acres; in Philadelphia the Pennsylvania Railroad controls two miles of water-front; and in Jersey City the Erie and Pennsylvania Railroads together occupy 250 acres, besides the large grounds near Amboy; and the New York Central has recently secured land enough in the city of New York to give it a water-front of over 3,000 feet. If Boston is to be a shipping port, and intends to secure its share of Western business, it is time to prepare these grounds for occupancy, and to provide by law for reaching them.

BACK BAY LANDS.

FEET.

The whole quantity of land in the Back Bay, so called,
 belonging to the State in 1857, was 4,723,998

FEET.

Prior to Dec. 1, 1879, there had been do-	
nated to scientific institutions . . .	144,738
Transferred to Trinity Church . . .	6,447
Transferred to city of Boston . . .	163,555
Devoted to streets and passage-ways . .	2,037,068.6
Sold, as per statement annexed . . .	2,084,931.6
Leaving unsold Dec. 1, 1879 . . .	287,257.8
	<hr/>
	4,723,998
	<hr/>

The gross proceeds of the land sold have been . . .	\$4,307,722 17
The rights of the State in Parker Street have been sold for	2,200 00
	<hr/>

Making the total gross receipts	\$4,309,922 17
The cost of filling, grading, &c. (see Land Commissioners' Second Report), prior to 1879, was . .	\$1,626,008 71
The cost of auction sales, &c., to July 1, 1879, as per sales-book, was . . .	14,291 78
	<hr/>
	1,640,300 49
	<hr/>

Net proceeds to Dec. 1, 1879	\$2,669,621 68
--------------------------------------	----------------

From this it appears, that, while only 44.13 per cent of the whole quantity of land belonging to the State has been sold (the remainder, except 287,257.8 feet unsold, having been given away or used in streets, &c.), the Commonwealth has already received a net profit of 56.51 cents per square foot for every foot owned by it in 1857; while the 2,084,931.6 feet of land sold have averaged \$2.066 per square foot gross, and, after deducting all expenses of filling, 4,723,998 feet have yielded a net profit of \$2,669,621.68, or \$1.28 per square foot sold.

Annexed to this report will be found a plan of the Back Bay lands, showing the date and price at which every foot of land belonging to the Commonwealth has been sold.

During May last the Land Commissioners sold at auction 32,868 feet of land upon Commonwealth Avenue for \$109,883.68, and, at private sale, 2,863½ feet for \$7,158.75.

The prices at which these sales were made were considered high, and from that time a better feeling existed in regard to

the value of Back Bay lands, although prior to Oct. 20 there was no active demand for land; but, within thirty days after, sales were made of—

33,739.5 feet on	.	.	.	.	Commonwealth Avenue.
31,192	"	.	.	.	Marlborough Street.
11,177.6	"	.	.	.	Beacon Street.
2,352	"	.	.	.	Newbury Street.

In all 78,461.1 feet, for \$242,270.75.

Upon these sales there were no charges of any kind, the Commissioners having made the sales without the intervention of brokers.

The land belonging to the Commonwealth, and still unsold, is all beyond Dartmouth Street, and is located as follows:—

					FEET.
Marlborough Street, north side	.	.	.	.	22,377.6
Marlborough Street, south side	.	.	.	.	25,345.6
					<hr/> 47,723.2
Commonwealth Avenue, north side	.	.	.	.	9,810.6
Commonwealth Avenue, south side	.	.	.	.	16,185
					<hr/> 25,995.6
Newbury Street, north side	.	.	.	.	45,808
Newbury Street, south side	.	.	.	.	46,928
					<hr/> 92,736
Boylston Street, north side	.	.	.	.	46,928
Boylston Street, south side	.	.	.	.	73,875
					<hr/> 120,803
					<hr/>
Total square feet	.	.	.	.	287,257.8

For the land upon Newbury and Boylston Streets, there is as yet no active demand; but, whenever the extension of those streets to the new park shall be completed, a ready sale at good prices is expected.

For the land upon Commonwealth Avenue and Marlborough Street, an early sale is anticipated at improving prices.

BRIDGES OVER COLE'S RIVER AND LEE'S RIVER.

The Fall River, Warren, and Providence Railroad Company, under the provisions of chap. 241 of the Acts of 1879, submitted for the approval of this Board plans for the reconstruction of its bridges over Cole's River and Lee's River

without draws. Notice was given to the selectmen of Swanze and Somerset, and a public hearing was had on the 24th of July. The selectmen of both towns appeared in opposition to closing the draws, and a strong local feeling was shown in favor of retaining them in both bridges.

At the hearing, the counsel for the remonstrants claimed that the Act of 1879 was unconstitutional; that a State has no power to authorize a bridge without a draw across a navigable river constituted by United States legislation a part of one of its ports. It was urged, that, as the Act was not mandatory, but conferred discretionary power only, if the authorities showed that the approval of a bridge without a draw would not protect the petitioner in erecting such bridge, such approval should be refused. The very important bearing of the question thus presented upon all the duties of the Board, as well as the weight of the suggestion of counsel in relation to the exercise of discretionary power, led to a somewhat careful examination of the authorities. For convenient reference hereafter, it may be useful to state briefly the result of this examination.

The limitation of State authority is supposed to arise from the provision of the Constitution of the United States, which gives to Congress power "to regulate commerce with foreign nations, and among the several States, and with the Indian tribes." The final and authoritative interpretation of this provision must be sought in the decisions of the Supreme Court of the United States. Its meaning was considered by that Court in *Gibbons v. Ogden*, 9 Wheat., 1, decided in 1824, wherein it was held that a State law, giving to certain persons for a term of years exclusive right to navigate the waters of that State with boats moved by steam or fire, was inoperative against the laws of the United States regulating the coasting trade. In the opinion by Marshall, C.J., the Court says, "The power of Congress, then, comprehends navigation within the limits of every State in the Union, so far as that navigation may be in any manner connected with commerce with foreign nations, or among the several States, or with the Indian tribes." The Court, however, declined to decide whether the power conferred upon Congress was exclusive, or whether a concurrent power over the same subject remained with the

States, as in either case, if the State law was in conflict with that of Congress, it must yield, inasmuch as the Constitution by express provision declares that it and the laws made in pursuance thereof are the supreme law of the land. The supremacy of Congress in the regulation of foreign and interstate commerce has been confounded with the exclusive control of it; and, in several cases, *Gibbons v. Ogden* has been cited by the same Court as having established the law that the power of Congress over the subject was exclusive. In *Willson v. the Blackbird Creek Marsh Co.*, 2 Pet., 250, however, a State law authorizing a dam across a navigable creek was held valid; and the Court said the power of Congress to regulate commerce with foreign nations, and among the several States, had not been so exercised as to affect the question, though the plaintiffs were owners of a vessel regularly licensed and enrolled for the coasting trade. The question was more fully considered in *Gilman v. Philadelphia*, 3 Wall, 713, decided in 1865. The power of Congress to control navigable waters that are accessible to interstate commerce, to keep them open and free from obstruction interposed by the States or otherwise, was asserted in this case as unequivocally as in any previous case; but it was fully recognized that the States have concurrent power over the same waters, qualified only by the supreme control which Congress may exercise; and State legislation authorizing a bridge without a draw over the Schuylkill River was held valid. It was admitted that the bridge would obstruct important navigation, and that it and the river above it were within the port of Philadelphia; yet the Court not only thought it competent for the State to permit and regulate the building of such a bridge, but that the State was the appropriate power to exercise the control required. The Court use this language: "It must not be forgotten that bridges, which are connecting parts of turnpikes, streets, and railroads, are means of commercial transportation, as well as navigable waters, and that the commerce which passes over a bridge may be much greater than would ever be transported on the water it obstructs. It is for the municipal power to weigh the considerations which belong to the subject, and to decide which shall be preferred, and how far

either shall be made subservient to the other. The States have always exercised this power; and, from the nature and objects of the two systems of government, they must always continue to exercise it, subject, however, in all cases, to the paramount authority of Congress whenever the power of the States shall be asserted within the sphere of the commercial power which belongs to the nation." It is true the Court were not unanimous in this decision, and a very earnest dissenting opinion was given by one of the judges; but the question was again carefully considered in *Pound v. Turk*, 95 U. S., 459, decided in 1877, and the doctrine of *Gilman v. Philadelphia* was re-affirmed as the settled law.

In the case before the Board, the railroad passing over the bridges extends into Rhode Island, and the business over it is largely interstate commerce. There would seem to be no greater reason for apprehending that Congress would interfere in behalf of commerce passing under the bridges to require draws, than in behalf of that passing over them to prohibit draws.

The only ground, aside from the legal position taken, urged for requiring draws in the bridges to be rebuilt, was the possibility that greater use might hereafter be made of the rivers. As the Act of 1879 contains adequate provision for obtaining a draw in either or both of the bridges whenever the circumstances should justify or require it, the Board determined that until otherwise ordered neither of said bridges should have a draw, and approved plans accordingly.

HARBOR LINE.

In the last Annual Report the subject of the study of the harbor lines, with a view to such redetermination of them as might appear, upon examination, to be desirable, was submitted as a sequence to the elaborate surveys which had been made. Since the completion of the maps, the Board have made a careful study of all the results of the resurvey together with a full consideration of the former harbor line, not only in reference to the defective data for its identification, but of the nearly obsolete and disadvantageous nature and location of many parts of it, and are fully con-

firmed in the conclusion that a revised and redetermined line is necessary for the proper legal and physical supervision of the harbor.

In view of the various projects for the treatment of Charles-river Basin, and from the fact that harbor lines have recently been established in that portion of the river, the Board deem it inexpedient to present any restatement of the harbor line above West Boston Bridge. The provisional legislation relating to South Bay is also sufficient for the action of the Commonwealth in regard to it, and no restatement of the harbor line is needed above Dover-street Bridge. In view of the projects for the improvement of the flats and frontage at and beyond East Boston, the Board deem it best to await further developments before dealing with this side of the harbor, in order that their own action may harmonize with other improvements.

The harbor line presented at this time provides for the frontage of the city proper only, including the city side of Fort Point Channel and Charles River, between Dover-street and West Boston Bridges; and also for the opposite side of Charles River, from West Boston Bridge to the Navy Yard. The Board have substantially concurred in the scheme prepared, at their request, for this portion of the frontage by Professor Henry L. Whiting, in regard to which he says, —

“ Without entering into a discussion of the principles of compensation or the complicated physical condition of the harbor, it is important to state, that the new harbor line so closely follows the present configuration of the harbor outline, as formed by actual structures, most of which have been standing for so long a time, that the impressions due to their condition and position have already been effected; that no physical influences, caused by such slight deviations from existing outlines as occur, have been taken into account. The project has been based, mainly, upon the adjustment of water-spaces to symmetrical lines of frontage best adapted to navigation and occupation. Where the revised harbor line does deviate from the former line and from existing outlines, it is for the purpose of correcting irregularities, and improving the general alignment of the harbor frontage.

“ In order that the revised harbor line may clearly and in fact define the *actual limits of the harbor*, it has been so projected that it will in no case fall *within* any *existing structure*, except where it may cross the lines of bridges. In some cases it coincides with the outer faces of wharf structures as they now exist; and many of the initial points or points of deflection in it are coincident with the outer corners of present wharves;

and the line has been projected with a view to the extension of other wharf and sea-wall structures to it; and it is desirable, if such structures are so brought out, they should coincide as nearly as practicable with the harbor line, while in no case should they extend beyond it."

After due consideration, the Board deem it expedient to recommend but one harbor line; and, although the suggestions by Professor Whiting of two parallel lines to define the coping and foundation lines of frontage structures have features of advantage, they are in a measure technical; and one line with proper restrictions seems sufficient to practically define the harbor outlines, and accords with all the precedents of similar legislation. The line now presented corresponds with, and is intended to be, a *coping line*, or a line with which the coping line of structures may coincide, but shall in no case exceed.

Professor Whiting further says, —

"An important feature in the work is the accurate determination and permanent marking of the points in the harbor line. Experience has proved that reference to local objects, even of apparently stable character, is insecure; and this fact was one of the reasons and requirements for a resurvey of the wharf-lines of the upper harbor, and for basing it upon the costly and perfectly determined triangulation of the United States Coast Survey, — the main points in this triangulation being so securely marked as to preserve them from the probable contingencies of accident. It was also a feature in the scheme of the resurvey to connect each initial point or point of deflection in the harbor line with the points in the harbor triangulation; in fact, to make the points of deflection in the harbor line actual points of triangulation. A practical difficulty, however, arises in the execution of this plan, from the fact that many of the points of deflection in the harbor line will fall in *water*. It became necessary, therefore, to locate and determine a point on some actual structure which would be accessible for instrumental occupation, and where local markings could be made as near as practicable to such points of deflection in the harbor line as could not be marked, and to make these points of triangulation '*reference points*' from which the points of deflection in the harbor line could be determined by measured or computed distance and direction."

This work has been done, and a series of reference points selected and marked, and the references to the points in the harbor line effected. With the execution of the observations and computations connecting these points of reference with the harbor triangulation, the work will be complete. The geographical position of each reference point, and of each

point in the harbor line, will then be given in tables similar to those for the same class of data published in the last report of the Board.

The work of selecting and marking the reference points, and the observations and computations connecting them with the points in the harbor line, has been executed by Mr. William E. McClintock with a degree of precision which has given to these final minute determinations the same exact character as the accurate bases from which they are derived.

The only important deviation from the general trend and location of the former harbor line occurs on the Charlestown side of Charles River, between the northern terminus of the Boston and Lowell Railroad passenger bridge and the Sheares Wharf of the United States Navy Yard.

Along this portion of the harbor frontage, the former system of harbor lines, prescribing the boundaries of Miller's River and Prison Point Bay, is no longer required; and the filling up of these water-spaces, for which compensation has been made, gives to the remaining water-way, which was formerly the entrance to Miller's River, the character of a dock, and as such it has been considered, so far as projecting the harbor line across its entrance is concerned.

By chap. 277 of the Acts of 1879, the Hoosac Tunnel Dock and Elevator Company were authorized to take or purchase the wharves and docks between Tudor's Wharf and the Navy Yard, and, subject to the approval of this Board, to extend its wharves beyond the harbor line. Nothing but an extraordinary commercial need could have justified the powers conferred upon this company; and it would require no less exigency to justify this Board in approving the extension of structures at this point into the deepest water of the harbor front, and at the narrowest point of the entrance to Charles River. The Board have very carefully considered the objections to the extension desired; but they recognize that there would be small encouragement for perfecting and preserving the harbor if it could not be adapted to the necessities of modern methods of commerce. The apathy of corporations and business-men in regard to the required provision for railroad terminal grounds on the water-front, and their want of faith in the growth of the export business, have seemed to this Board and its predecessors sur-

prising. If there is arising a recognition of the pressing character of this need in any quarter, and a disposition of any parties to prove their faith in the business by providing facilities from the expenditure of their own money, asking no gift or aid from the public treasury, it is important that the fullest freedom should be given to such enterprise consistent with the guarding of what is essential to the safety of the harbor. Weighing these considerations carefully, and consulting the best scientific authority to which it had access, the Board has reached the conclusion, that, for the important purpose to promote which the legislature thought proper to give the right of eminent domain, the desired extension may be permitted. If the extension is made for this purpose, it is desirable that the line should be continuous from Charles-river Bridge to the Navy Yard; and the line is revised accordingly. The revision of the line above Charles-river Bridge, in connection with that below, will enable the Fitchburg Railroad Company to improve their terminal facilities, in connection with the Elevator Company, without serious additional disadvantages to the physical functions of the harbor.

Before drawing the lines, as herein prescribed, the Board gave public notice to all parties interested, as required by statute; and on the 18th of December a public hearing was afforded thereon, at which there were no objections or dissenting criticism made. Whereupon the Board report the following harbor line for the consideration of the legislature, and recommend that it be established by statute:—

The points which are points of deflection, and designated by the letters A, B, C, A^a, B^a, C^a, &c, and the points of reference from the said points of deflection, designated A', A'', A''', B', B'', B''', A^{a'}, A^{a''}, A^{a'''}, &c., in the following description of the harbor line, are drawn upon the map showing the said harbor line, and are written in the book of recorded data relating thereto in corresponding letters at the points indicated.

Each point of reference, where it is not an existing object, is marked in the substance and on the surface of the ground or structure where the point is located by a copper tack driven through a hole in the centre of an iron plate; said iron plate being about six inches square, and having the

words "Harbor Line" cast in the surface of each plate. In all cases where the points of deflection in the harbor line fall upon actual structures, they are also marked by similar copper tacks and iron plates.

The bearing, from the points of deflection in the harbor line to any point of reference, is in each case the angle with a line parallel to the true meridian passing through the State House, measured from south around by west; the geographical position of the State House being latitude $42^{\circ} 21' 27''.62$, longitude $71^{\circ} 03' 30''.00$.

The distances are given in feet and decimals.

The harbor line on the frontage of the city proper begins at point A on the northerly side of Dover-street Bridge, at its junction with the face of the wharf, and is marked by a copper tack through an iron plate on the face of the capsill, and is referred to points A' and A''. A' is on the plank sidewalk on the southerly side of Dover-street Bridge, and is marked by a copper tack through an iron plate: the bearing from point A to A' is the same as the harbor line between the points A and B. Point A'' is at the south-easterly corner of a brick building at the north-easterly corner of Dover and Albany Streets: distance from points A to A'', 122.54 feet; bearing from point A to A'', $104^{\circ} 46' 23''$.

Thence the harbor line runs northerly to point B, which is at the northerly corner of Pope's upper wharf, and is referred to point B' on the capsill of Pope's lower wharf, and is marked by a copper tack through an iron plate: distance from B to B', 35.60 feet; bearing from B to B', $198^{\circ} 03' 19''$.

Thence the harbor line runs northerly to point C, which is at the southerly corner of Furber & Bailey's wharf, and is referred to point C' on the capsill of the same wharf, and is marked by a copper tack through an iron plate: distance from C to C', 38.00 feet; bearing from C to C', $290^{\circ} 00' 20''$.

Thence the harbor line runs northerly to point D, which is at the southerly corner of Gutterson's wharf, and is referred to point D' on the northerly corner of Hamm's wharf, and is marked by a copper tack through an iron plate on the capsill: distance from D to D', 48.78 feet; bearing from D to D', $39^{\circ} 32' 04''$.

Thence the harbor line runs northerly to point E, which is near the intersection of the southerly side of Broadway

Bridge and the face of the wharf, and is referred to point E' on the southerly corner of the Boston and Albany Railroad wharf under Broadway Bridge, and is marked by a copper tack through an iron plate on the diagonal corner-brace framed into the capsill of the wharf: distance from E to E', 36.92 feet; bearing from E to E', $236^{\circ} 26' 53''$.

Thence the harbor line runs northerly to point F, which is at the angle in the Boston and Albany Railroad wharf about 100 feet below Broadway Bridge, and is referred to point F' on the capsill of the same wharf, and is marked by a copper tack through an iron plate: distance from F to F', 0.45 feet; bearing from F to F', $181^{\circ} 14' 42''$.

Thence the harbor line runs northerly to point G, which is at the face of the Boston and Albany Railroad wharf, at its intersection with the harbor line between the points G and H; said point G being about $24\frac{1}{2}$ feet from the corner of the same wharf, and is referred to points G' and G''. Point G' is on the harbor line between the points G and H, where said last-named line crosses the Old Colony Railroad bridge, and is about 65 feet south-westerly from the corner of a freight-shed, and is marked by a copper tack through an iron plate: distance from G to G', 206.18 feet; bearing from G to G' is the same as the harbor line between the points G and H. Point G'' is on the capsill of the same wharf as point G, and is marked by a copper tack through an iron plate: distance from G to G'', 22.78 feet; bearing from G to G'', $226^{\circ} 54' 57''$.

Thence the harbor line runs northerly to point H, which is the point of commencement of a curve in the harbor line of 338 feet radius; the harbor lines between the points G and H and between the points I and K being tangent thereto. The radius of curve is 338 feet; the length of tangent is 109.29 feet; the arc passed through is $35^{\circ} 50' 16''$. Point H is referred to point H' on northerly side of Federal-street Bridge, where the harbor line between the points G and H crosses said Federal-street Bridge, and is marked by a copper tack through an iron plate on the face of the capsill; also by a copper tack in the outside corner of the sidewalk cap: distance from H to H', 186.02 feet; bearing from H to H', the same as the harbor line between the points G and H.

Thence the harbor line runs northerly on an arc of a circle of 338 feet radius to point I, which is the point of termination of the curve whose point of commencement is at point H. Said point I is near Austin Wellington's wharf, and is referred to point I' on the southerly side of Mount Washington Avenue Bridge, where the harbor line between the points I and K crosses said Mount Washington Avenue Bridge, and is marked by a copper tack through an iron plate: distance from I to I', 464.84 feet; the bearing from I to I' is the same as the harbor line between the points I and K.

Thence the harbor line runs northerly to point K, which is at the angle in the outer face of Otis's wharf, about 80 feet south-westerly from the Pioneer Floating Dry Dock, and is referred to points K' and K''. Point K' is on the capsill of Otis's wharf, and is marked by a copper bolt through an iron plate: distance from K to K', 0.58 feet; bearing from K to K', $146^{\circ} 55' 52''$. Point K'' is at the south-easterly brick corner of a brick building on the northerly side of the entrance to Arch Wharf: distance from K to K'', 160.34 feet; bearing from K to K'', $62^{\circ} 11' 47''$.

Thence the harbor line runs northerly to point L, which is at the southerly corner of Long Wharf, and is referred to points L', L'', and L'''. Point L' is also on the same southerly corner of the said Long Wharf, and is marked by a copper tack through an iron plate on the capsill: distance from L to L', 0.59 feet; bearing from L to L', $105^{\circ} 43' 35''$. Point L'' is at the south-easterly corner of a brick building at the outer end of the said Long Wharf: distance from L to L'', 218.23 feet; bearing from L to L'', $107^{\circ} 57' 48''$. Point L''' is at the south-westerly corner of the same building last named; bearing from L'' to L''', $78^{\circ} 10' 43''$.

Thence the harbor line runs northerly to point M, which is at the northerly corner of Long Wharf, and is referred to points L'' and L''' before described, and also to point M' on the northerly corner of the said Long Wharf: distance from M to L'', 259.92 feet; bearing from M to L'', $53^{\circ} 42' 05''$: distance from M to M', 1.09 feet; bearing from M to M', $52^{\circ} 02'$.

Thence the harbor line runs northerly to point N, which is on the northerly corner of Union Wharf, and is referred to

point N' on the same northerly corner of the said Union Wharf, and is marked by a copper tack through an iron plate on a three-inch-thick false cap, which is spiked to the capsill of the wharf: distance from N to N', 1.29 feet; bearing from N to N', $26^{\circ} 01' 05''$.

Thence the harbor line runs northerly to point O, which is at the southerly corner of Battery South Wharf, and is referred to point O' on the same southerly corner of the said Battery Wharf, and is marked by a copper tack through an iron plate on the front capsill: distance from O to O', 1.53 feet; bearing from O to O', $179^{\circ} 29'$.

Thence the harbor line runs northerly to point P, which is at the northerly corner of Battery South Wharf, and is referred to point P' on the planking at the same northerly corner of the said Battery South Wharf, and is marked by a copper tack through an iron plate: distance from P to P', 2.43 feet; bearing from P to P', $29^{\circ} 44' 14''$.

Thence the harbor line runs northerly to point Q, which is at the southerly corner of Constitution Wharf, and is referred to point Q' on the same southerly corner of the said Constitution Wharf, and is marked by a copper tack through an iron plate: distance from Q to Q', 5.14 feet; bearing from Q to Q', $130^{\circ} 15'$.

Thence the harbor line runs westerly to point R, which is at the northerly corner of Constitution Wharf, and is referred to point R' on the planking at the same northerly corner of the said Constitution Wharf, and is marked by a copper tack through an iron plate: distance from R to R', 2.15 feet; bearing from R to R', $72^{\circ} 37'$.

Thence the harbor line runs easterly to point S, which is near the easterly corner of Fisk's wharf, about in the line of the easterly side of the wharf produced, and is referred to point S' on the outer end of the said Fisk's wharf, near a derrick, and is marked by a copper tack through an iron plate: distance from S to S', 87.95 feet; bearing from S to S', $95^{\circ} 25' 02''$.

Thence the harbor line runs westerly to the point T, which is near the angle in the outer face of Bartlett's south wharf, and is referred to point T' on the same outer point of the said Bartlett's south wharf, and is marked by a copper tack through an iron plate. Point T is also referred to a

point in the triangulation of 1877-78, called "Gray's wharf," which is at the north-westerly corner of a brick building on the said Gray's wharf: distance from T to T', 10.24 feet; bearing from T to T', $67^{\circ} 12' 15''$: distance from Gray's wharf to T', 68.44 feet; bearing from Gray's wharf to T', $12^{\circ} 28' 44''$.

Thence the harbor line runs westerly to point U, which is at the westerly corner of Bartlett's north wharf, and is referred to point U', which is on the easterly corner of the said Bartlett's north wharf, and is marked by a copper tack through an iron plate on the planking of the wharf: distance from U to U', 108.10 feet; bearing from U to U', $268^{\circ} 55' 43''$.

Thence the harbor line runs westerly to point V, which is at the angle in the outer face of the wharf of the Boston Gas-Light Company, about 187 feet from the easterly line of the last-named company's land, and is referred to point V' on the sill of the easterly coal-shed, and is marked by a copper tack through an iron plate: distance from V to V', 34.82 feet; bearing from V to V', $337^{\circ} 00' 22''$.

Thence the harbor line runs westerly to point W, which is at the angle in the outer face of the wharf of the Boston Gas-Light Company, next westerly from the angle at the point V last described, and is referred to point W' on the sill used as a guard on the west side of a passage-way between two coal-sheds on the said Gas-Light Company's wharf, and is marked by a copper tack through an iron plate: distance from W to W', 45.51 feet; bearing from W to W', $294^{\circ} 10' 23''$.

Thence the harbor line runs westerly to point X, which is at the westerly side of Charles-river Bridge at its intersection with the wharf-line, and is marked by a copper tack through an iron plate on the capsill outside of the sidewalk.

Thence the harbor line runs westerly to point Y, which is at the easterly side of Warren Bridge, about 17 feet north-erly from the outer face of Lovejoy's wharf, and is marked by a copper tack through an iron plate on the capsill outside of the sidewalk.

Thence the harbor line runs westerly to point Z, which is at the easterly side of the Boston and Maine Railroad bridge, where it intersects the face of the wharf at the head of the dock, and is marked by a copper tack through an iron plate.

Thence the harbor line runs westerly to point A^a , which is at the easterly side of the Eastern Railroad bridge, about 138 feet northerly from the head of the dock, and is marked by a copper tack through an iron plate, and is also referred to point $A^{a'}$ at the north-easterly corner of the Boston and Lowell passenger station, at the outer corner of the stone plinth of the buttress: distance from A^a to $A^{a'}$, 138.03 feet; bearing from A^a to $A^{a'}$, $33^\circ 43' 08''$. A^a is also referred to $A^{a''}$, which is at the westerly side of the Boston and Lowell Railroad passenger bridge at the intersection with the northerly face of the said Boston and Lowell freight bridge, and is marked by a copper tack through an iron plate on the capsill; said point $A^{a''}$ being in the alignment of the harbor line between the points A^a and B^a .

Thence the harbor line runs westerly to point B^a , which is at the northerly side of the Boston and Lowell freight bridge, where it begins to curve, and is marked by a copper tack, and is also referred to point $B^{a'}$, which is on the same northerly side of the said Boston and Lowell freight bridge, and in the alignment of the harbor line between the points A^a and B^a produced, and is marked by a copper tack through an iron plate on the capsill: distance from B^a to $B^{a'}$, 36.18 feet; bearing from B^a to $B^{a'}$, the same as line between points A^a and B^a .

Thence the harbor line runs westerly to point C^a , which is at the northerly side of Craigie's Bridge, about 16 feet south-easterly from the old draw-pier, and is marked by a copper tack through an iron plate, and is also referred to point $C^{a'}$, which is at the easterly corner of the stone step to a brick building at the intersection of the easterly side of Charles Street and the southerly side of Leverett Street: distance from C^a to $C^{a'}$, 221.52 feet; bearing from C^a to $C^{a'}$, $320^\circ 28' 19''$.

Thence the harbor line runs southerly to point D^a , which is at the northerly corner of the wharf between Poplar and Allen Streets, and is referred to points $D^{a'}$ and $D^{a''}$. Point $D^{a'}$ is at the southerly side of the scale-frame at the entrance from Charles Street to the Boston Gas-Light Company's wharf, and is marked by a copper tack through an iron plate: distance from D^a to $D^{a'}$, 248.32 feet; bearing from D^a to $D^{a'}$, $259^\circ 09' 31''$. Point $D^{a''}$ is at the corner of a brick building

at the angle in the easterly side of Charles Street, about 122 feet northerly from the northerly side of Poplar Street: distance from D^a to $D^{a''}$, 339.5; bearing from D^a to $D^{a''}$, $257^\circ 54' 35''$.

Thence the harbor line runs southerly to point E^a , which is at the northerly side of West Boston Bridge at its intersection with the sea-wall, and is marked by a copper tack through an iron plate on the cap outside of the brick sidewalk, and is also referred to points $E^{a'}$ and $E^{a''}$. Point $E^{a'}$ is at the north-easterly corner of the brick building on the south-westerly corner of Charles and Cambridge Streets: distance from E^a to $E^{a'}$, 136.11 feet; bearing from E^a to $E^{a'}$, $297^\circ 08' 38''$. Point $E^{a''}$ is at the south-westerly corner of the jail-yard fence about 80 feet northerly from the north-westerly corner of a brick building on the north-easterly corner of Charles and Cambridge Streets: distance from E^a to $E^{a''}$, 188.52 feet; bearing from E^a to $E^{a''}$, $253^\circ 23' 22''$.

The harbor line on the frontage of Cambridge and Charlestown begins at point A, at the northerly side of West Boston Bridge at its intersection with the face of the wharf, and is marked by a copper tack through an iron plate on the cap outside of the brick sidewalk.

Thence the harbor line runs north-easterly to point B, which is on the southerly side of Craigie's Bridge at its intersection with the face of the wharf, and is marked by a copper tack through an iron plate on the cap outside of the sidewalk, and is referred to point B' , which is at the south-easterly corner of the Boston and Lowell machine-shop: distance from B to B' , 73.39 feet; bearing from B to B' , $224^\circ 46' 19''$.

Thence the harbor line runs north-easterly to point C, at the southerly side of the Boston and Lowell Railroad passenger bridge at its intersection with the face of the wharf, and is marked on the capsill of the bridge by a copper tack through an iron plate.

Thence the harbor line runs easterly to point D, which is at the westerly side of Warren Bridge, about 100 feet southerly from the outer face of the wharf on the same easterly side of the said Warren Bridge, and is marked by a copper tack through an iron plate.

Thence the harbor line runs easterly to point E, which is at the easterly side of Charles-river Bridge, about 80 feet

southerly from the outer face of Tudor's wharf on the same easterly side of the said Warren Bridge, and is marked by a copper tack through an iron plate.

Thence the harbor line runs north-easterly to point F, which is about 80 feet south-easterly from the south-westerly corner of Hittenger's wharf, and nearly in the alignment of the westerly side of said Hittenger's wharf produced, and is referred to point E: distance from point F to point E, 379.00 feet; bearing from point F to point E is the same as the harbor line between said points E and F.

Thence the harbor line runs north-easterly to point G, which is at the south-westerly corner of the Navy Yard Shear's Wharf, and is referred to point G', which is near the same south-westerly corner of the said Navy Yard Shear's Wharf, and is marked by a copper tack through an iron plate: distance from G to G', 1.40 feet; bearing from G to G', $150^{\circ} 35' 00''$.

OFFICE AND FIELD WORK.

The routine work connected with the harbor duties of the Board, and the number of licenses granted, have been beyond the general average of former years. About one-quarter of the whole number of structures authorized to be built have been in Boston Harbor and vicinity: the remaining structures licensed have been distributed among the other harbors of the Commonwealth. This result of the yearly business of the Board shows an encouraging demand for harbor occupation, and the increase of facilities in them. The engineers of the Board have been fully engaged in field examinations, surveys, and office work.

The following statistics show the particulars of the work:—

Plans approved by the Board of Harbor Commissioners and the Board of Harbor and Land Commissioners, during the Year 1879, for the Erection of Structures in or over the Tide-Water, and Licenses granted for such Structures.

Nos.

451. Frank R. Kimball, for leave to construct a stone pier in front of his upland on Marblehead Neck. Approved Jan. 8, 1879.
452. John E. Wennerberg, for leave to construct a pile-wharf in Gloucester Harbor. Approved Jan. 8, 1879.
453. Alfred P. Norwood, for leave to construct a pile-wharf in Smith's Cove, East Gloucester. Approved Jan. 29, 1879.
454. John F. Wonson & Co., for leave to construct a pile-wharf in Smith's Cove, East Gloucester. Approved Jan. 29, 1879.
455. Daniel Gill, for leave to construct a pile-wharf in Smith's Cove, East Gloucester. Approved Jan. 29, 1879.
456. Sidney W. Oakes and Elisha M. Oakes, for leave to construct a pile-wharf in Smith's Cove. Approved Jan. 29, 1879.
457. Pigeon Hill Granite Company, for leave to build a breakwater and wharf in Rockport Harbor. Approved Feb. 5, 1879.
458. City of Boston, for leave to rebuild the draw-pier in Essex Street, or Cottage Farm Bridge, crossing Charles River. Approved Feb. 19, 1879.
459. Boston and Lowell Railroad Corporation, for leave to construct additions to its freight-bridge on the Boston side between its bridge and Craigie's Bridge. Approved March 12, 1879.
460. City of Boston, for leave to rebuild and enlarge the steamboat-wharf on Deer Island, Boston Harbor. Approved March 19, 1879.
461. Selectmen of the town of Falmouth, for leave to extend the bridge across the channel leading from Wood's Holl, Great Harbor, into the Mill Pond. Approved March 19, 1879.
462. Onset Bay Grove Association, for leave to construct a bridge over Swift's River in the town of Wareham. Approved March 19, 1879.
463. Jane A. Nelson, for leave to construct a wharf on Rocky Neck, Gloucester Harbor, partly solid and partly on piles. Approved March 19, 1879.
464. Old Colony Railroad Company, for leave to widen Derrick Wharf on Taunton Great River, city of Fall River. Approved March 26, 1879.
465. William E. Ansell, for leave to construct a pile-wharf on Rocky Neck, Gloucester Harbor. Approved April 2, 1879.
466. Putnam Nail Company, for leave to construct a pile-wharf in front of its works on Neponset River. Approved April 2, 1879.
467. Butchers' Slaughtering and Melting Association, for leave to fill solid a portion of its wharf on Charles River. Approved April 9, 1879.
468. Massasoit Steam Mill, for leave to extend its-wharf on Taunton Great River, city of Fall River. Approved April 9, 1879.

Nos.

469. County Commissioners of Plymouth County, for leave to construct a pile-bridge across Green Harbor River in the town of Marshfield. Approved April 12, 1879.
470. Selectmen of Medford, for leave to build a stone bridge across Mystic River in place of Craddock Bridge. Approved April 30, 1879.
471. City of Taunton, for leave to rebuild its bridge across Taunton River at Weir Village. Approved April 30, 1879.
472. City of Cambridge, for leave to construct a ballast-wall on Charles River on the south side of Main Street, Cambridge. Approved May 7, 1879.
473. Jeffries Club, for leave to drive piles to keep its float-stage in position at Jeffries Point, East Boston. Approved May 14, 1879.
474. Samuel Downer, for leave to widen his southerly wharf at Downer Landing in the town of Hingham. Approved July 10, 1879.
475. William Johnston, for leave to build a wharf at the foot of Sixth Street, South Boston Point. Approved May 28, 1879.
476. Boston, Winthrop, and Point Shirley Railroad Company, for leave to construct its road around Winthrop Head to Point Shirley. Approved May 28, 1879.
477. Joseph K. Baker, for leave to widen his wharf on Nantucket Sound in the town of Dennis. Approved June 4, 1879.
478. Lewis C. Swift, for leave to construct a stone pier at Wood's Holl, Great Harbor. Approved June 11, 1879.
479. Selectmen of Westport, for leave to construct a solid wharf on the south side of Hicks's Bridge, across Westport River. Approved June 11, 1879.
480. Ignatius A. Kelly, for leave to drive piles to keep a float-stage in position at north side of Jeffries Point, East Boston. Approved June 18, 1879.
481. T. Bullen & Son, for leave to extend their wharf on Merrimac River, city of Haverhill. Approved June 18, 1879.
482. City of Boston, for leave to construct a sea-wall across a part of Roxbury Canal. Approved June 25, 1879.
483. J. H. Brown, for leave to extend his wharf in Marblehead Harbor. Approved June 25, 1879.
484. Latimer S. and F. W. Seaver, for leave to construct a pile-wharf on Plymouth Long Beach. Approved June 28, 1879.
485. Staples and Phillips, for leave to extend their wharf on Taunton River at Weir Village, city of Taunton. Approved July 17, 1878.
486. City of Boston, for leave to construct embankments, sea-walls, wharves, and other structures in connection with the system of improved sewerage at Old Harbor Point, Dorchester Bay. Approved July 28, 1879.
487. Proprietors of Boston Pier, or Long Wharf, for leave to widen its present wharf on the southerly side. Approved Aug. 7, 1879.

Nos.

488. Fall River, Warren, and Providence Railroad Company, for leave to reconstruct its bridges over Lee's and Cole's River, without draws, in the towns of Somerset and Swanzev. Approved Aug. 7, 1879.
489. J. H. White, for leave to build a sea-wall in front of his premises bordering on Marblehead Harbor. Approved Aug. 21, 1879.
490. Latimer S. Seaver, for leave to build a wharf on the south-westerly side of Captain's Hill, Duxbury. Approved Aug. 28, 1879.
491. Henry Breed, for leave to fill solid a portion of his pile-wharf in Lynn Harbor. Approved Aug. 28, 1879.
492. Maverick Oil Company, for leave to extend its wharf in Chelsea Creek, East Boston. Approved Aug. 28, 1879.
493. City of Boston, for leave to rebuild and widen part of Western-avenue Bridge across Charles River. Approved Sept. 11, 1879.
494. Nathaniel Webster, for leave to extend two wharves on piles to the harbor line in Gloucester Harbor. Approved Sept. 18, 1879.
495. City of Boston, for leave to construct embankments, sea-walls, and other structures, in connection with the system of improved sewerage between Old Harbor Point and Squantum, and between Squantum and Moon Island, Boston Harbor. Approved Sept. 22, 1879.
496. The same.
497. Joseph E. Stearns, for leave to construct a pile boat-pier at Monument Beach, town of Sandwich. Approved Sept. 25, 1879.
498. Amos A. Story, for leave to fill solid a portion of his wharf on Smith's Cove, East Gloucester. Approved Sept. 25, 1879.
499. Heirs of the estate of William Collins, for leave to extend their wharf in Harbor Cove, Gloucester Harbor. Approved Sept. 25, 1879.
500. Central Wharf and Wet Dock Corporation, for leave to make an addition to its present wharf on the south side. Approved Oct. 2, 1879.
501. Fred H. Seavey and others, for leave to construct a wharf near the foot of Charles Street in the town of Winthrop. Approved Oct. 9, 1879.
502. Pacific Guano Company, for leave to build a sea-wall, and fill the area enclosed, at Wood's Holl, Great Harbor. Approved Oct. 9, 1879.
503. Eben B. Phillips and others, for leave to build a plank pier or walk on Whale Beach in Swampscott. Approved Oct. 16, 1879.
504. Boston, Revere Beach, and Lynn Railroad Company, for leave to build a wharf and ferry-slip between Rowe's and Foster's wharves. Approved Oct. 23, 1879.
505. Henry E. Bradlee, petition for leave to rebuild and extend his wharf in Chelsea Creek, Chelsea side. Approved Oct. 23, 1879.
506. Michael Hurley, for leave to fill land-flats on Beach Street, and enclose the same by a wall, Lynn Harbor. Approved Nov. 13, 1879.

Nos.

508. Boston, Revere Beach, and Lynn Railroad Company, for leave to construct a wharf and ferry-slip in front of its property at East Boston. Approved Nov. 14, 1879.
509. Joseph W. Clarke, for leave to fill a strip of flats lying between the New York and New England Railroad Company's land and B Street, South Boston. Approved Nov. 20, 1879.
510. Steamboat Wharf Company of Chatham, for leave to extend its wharf at Stage Harbor, Chatham. Approved Dec. 11, 1879.
511. The Chatham and Harwich Marine Railway, for leave to construct a marine railway at Stage Harbor, Chatham. Approved Dec. 11, 1879.

FUND FOR THE MAINTENANCE OF THE WORK OF THE BOARD.

In the re-organization of the work of this Board which was made by the last legislature, it was desired by the committee having it in charge that some plan should be matured by which the Board and its work could be maintained independent of taxation. The present Board has given the subject some study, in the hope of presenting a plan by which this could be accomplished. Sufficient revenue for the maintenance of the work could not be obtained from fees imposed upon the licenses granted, without making such fees burdensome; but some revenue might equitably be derived from this source. A uniform fee for each license granted would not be practicable, unless it were made so small that the revenue derived would be unimportant. Many licenses granted are for small extensions of existing structures, or for structures in localities where their value is small; and a considerable fee would often be prohibitive of desirable improvements. If it should be deemed expedient to establish fees for licenses, the Board would recommend that discretion be given as to the amount to be charged, a minimum and maximum being fixed by statute.

Prior to the consolidation of the Land Commission with the agents for South Boston Flats in 1877, the appropriations for the maintenance of the Land Commission were made from the moiety of the proceeds of sales applicable to improvements. If the work of the present Board embraced nothing but the development and sale of Back Bay land, there would be no question but that this practice ought to be resumed. As the whole work of the Board is, in fact, the

care of the public interest in tide-water, and in the lands under or reclaimed from it, there would be manifest propriety in making provision from the profits of the Commonwealth's first encroachment upon the water, for the permanent care of that which remains. It is worthy of consideration whether from the proceeds of Back Bay lands not yet appropriated elsewhere, or from those hereafter received, something should not be reserved toward a fund for the permanent maintenance of the work in question.

The project of the reclamation of flats at South Boston grew out of a study of the needs of the harbor, and has been prosecuted with recognition of those needs. As the project has developed, the legislature has determined, that, without in any way permitting the harbor to suffer therefrom, the enterprise shall be conducted in future, as was the Back Bay reclamation, for the benefit of the treasury of the Commonwealth. Provision for the expense of prosecuting the work and guarding the harbor, by a reservation from the proceeds of the reclamation, would be very proper.

By chap. 284 of the Acts of 1874, it is provided, that, when wharves or other structures in tide-water are extended under license below the line of riparian ownership, the party licensed shall pay into the treasury, before the work is begun, such compensation as shall be determined by the Governor and Council to be just and equitable. Under this provision \$42,588.38 have been received for such occupancy of tide-lands since the passage of the Act. This legislation grew out of the work of the Board; and the money thus secured is directly due to the supervision it exercises, and could with great propriety be applied to the creation of the fund desired.

As the net receipts from the three sources named are now carried to the same sinking fund, the practical result would be the same from whichever the reservation were made.

From one or all the sources above indicated, a fund could be established, derived entirely from moneys received through the work of the Board independent of taxation, from which the appropriations for its maintenance could be made. It is not desirable that the fund should be received or controlled by the Board; but should be held by the Treasurer, as other funds of the Commonwealth, applicable only to the purpose

named, as the legislature should determine by appropriation from year to year. The receipts secured should be in excess of appropriations, sufficient to secure, before the probable exhaustion of the sources from which they are to be derived, a fund adequate to yield an annual income large enough to maintain the work. It can scarcely be doubted that each new service which government assumes should be made self-supporting, independent of taxation, so far as is practicable; and, while desirous of avoiding crude experiments or hastily conceived plans, we are satisfied that a plan somewhat like that we have outlined is feasible.

The work of the General Government in the harbors of the Commonwealth during the year will be found in statements kindly furnished the Board by the officers in charge, which are printed in the Appendix. The Board would acknowledge obligations to Gens. Thom and Warren, U.S.A., for courtesies received.

ALBERT MASON.
WILLARD P. PHILLIPS.
FRANCIS A. NYE.

Boston, Jan. 1, 1880.



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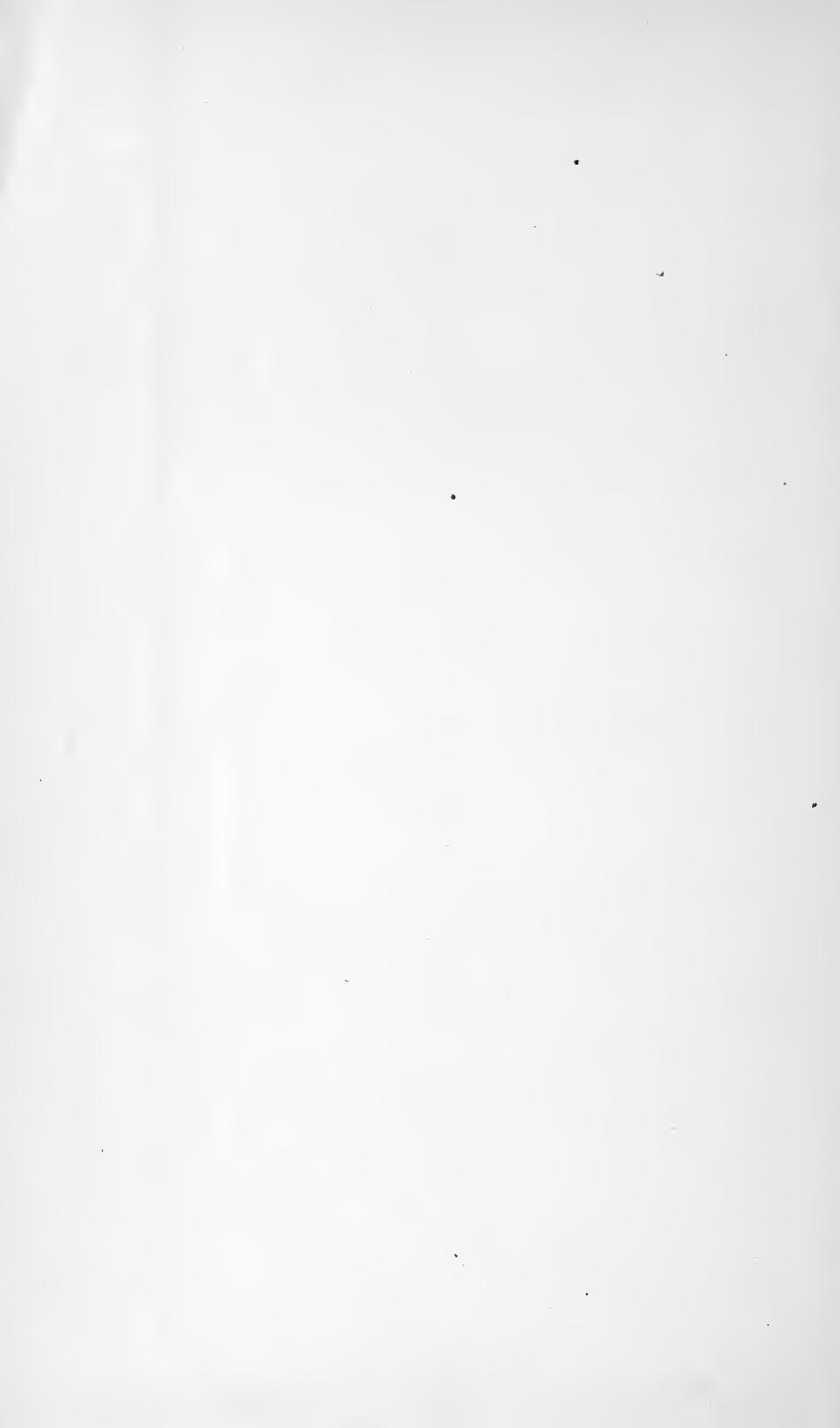
Shirley F. Ship

1871/72	1872/73	1873/74	1874/75	1875/76	1876/77	1877/78	1878/79	1879/80	1880/81	1881/82	1882/83	1883/84	1884/85	1885/86	1886/87	1887/88	1888/89	1889/90	1890/91	1891/92	1892/93	1893/94	1894/95	1895/96	1896/97	1897/98	1898/99	1899/00	1900/01	1901/02	1902/03	1903/04	1904/05	1905/06	1906/07	1907/08	1908/09	1909/10	1910/11	1911/12	1912/13	1913/14	1914/15	1915/16	1916/17	1917/18	1918/19	1919/20	1920/21	1921/22	1922/23	1923/24	1924/25	1925/26	1926/27	1927/28	1928/29	1929/30	1930/31	1931/32	1932/33	1933/34	1934/35	1935/36	1936/37	1937/38	1938/39	1939/40	1940/41	1941/42	1942/43	1943/44	1944/45	1945/46	1946/47	1947/48	1948/49	1949/50	1950/51	1951/52	1952/53	1953/54	1954/55	1955/56	1956/57	1957/58	1958/59	1959/60	1960/61	1961/62	1962/63	1963/64	1964/65	1965/66	1966/67	1967/68	1968/69	1969/70	1970/71	1971/72	1972/73	1973/74	1974/75	1975/76	1976/77	1977/78	1978/79	1979/80	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	2031/32	2032/33	2033/34	2034/35	2035/36	2036/37	2037/38	2038/39	2039/40	2040/41	2041/42	2042/43	2043/44	2044/45	2045/46	2046/47	2047/48	2048/49	2049/50	2050/51	2051/52	2052/53	2053/54	2054/55	2055/56	2056/57	2057/58	2058/59	2059/60	2060/61	2061/62	2062/63	2063/64	2064/65	2065/66	2066/67	2067/68	2068/69	2069/70	2070/71	2071/72	2072/73	2073/74	2074/75	2075/76	2076/77	2077/78	2078/79	2079/80	2080/81	2081/82	2082/83	2083/84	2084/85	2085/86	2086/87	2087/88	2088/89	2089/90	2090/91	2091/92	2092/93	2093/94	2094/95	2095/96	2096/97	2097/98	2098/99	2099/00	2100/01	2101/02	2102/03	2103/04	2104/05	2105/06	2106/07	2107/08	2108/09	2109/10	2110/11	2111/12	2112/13	2113/14	2114/15	2115/16	2116/17	2117/18	2118/19	2119/20	2120/21	2121/22	2122/23	2123/24	2124/25	2125/26	2126/27	2127/28	2128/29	2129/30	2130/31	2131/32	2132/33	2133/34	2134/35	2135/36	2136/37	2137/38	2138/39	2139/40	2140/41	2141/42	2142/43	2143/44	2144/45	2145/46	2146/47	2147/48	2148/49	2149/50	2150/51	2151/52	2152/53	2153/54	2154/55	2155/56	2156/57	2157/58	2158/59	2159/60	2160/61	2161/62	2162/63	2163/64	2164/65	2165/66	2166/67	2167/68	2168/69	2169/70	2170/71	2171/72	2172/73	2173/74	2174/75	2175/76	2176/77	2177/78	2178/79	2179/80	2180/81	2181/82	2182/83	2183/84	2184/85	218
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Presented to the Massachusetts Institute of Technology and the Boston Society of Natural History in answer to the Legislature approved April 10 1861
MS20.9.29



APPENDIX.



APPENDIX.

[A.]

THIS indenture, made this sixth day of September in the year eighteen hundred and seventy-nine by and between the Commonwealth of Massachusetts, acting by its Board of Harbor and Land Commissioners, subject to the approval of the Governor and Council, party of the first part, and Jesse Boynton of Providence in the State of Rhode Island, and Lyman Boynton of Boston in the Commonwealth of Massachusetts, copartners under the firm name of Boynton Brothers, parties of the second part, witnesseth that the said parties of the second part hereby covenant and agree with said party of the first part to fill B Street on the South Boston Flats, from Eastern Avenue to First Street, to grade thirteen, with material dredged from the harbor, and to do said filling in accordance with the lines, grades, and instructions which shall be given by the engineer of the Harbor and Land Commissioners, and to furnish all necessary aid and materials for giving said lines and grades.

Said filling within the area of B Street shall be protected on the sides by extending the same at the same grade six feet beyond the location, and thence sloping to the existing grade of the flats by a slope of eight to one on the easterly side, and four to one on the westerly side, except that the party of the first part may, at its election, provide other means of retaining the filling on either side or on any portion of the same, in which case the parties of the second part will not be required to protect the filling at the point where such other provision is made. The material for said filling shall be dredged from the harbor at such places as shall be assigned by the engineer of the Harbor and Land Commissioners, and by uniform excavation to the depth of twenty-three feet at mean low water; and both the dredging and filling shall be executed to the satisfaction of the said engineer. Said parties of the second part covenant and agree to commence the execution of said work within thirty days from date hereof, and to prosecute the same with all reasonable despatch, and to complete the same on or before the first day of July next.

Said party of the first part hereby covenants and agrees with said parties of the second part to pay them for said filling at the rate of thirty-three and three-quarters cents per cubic yard measured in the work when completed. Monthly estimates of the work executed will be

made, and eighty per cent of the contract price paid thereon, the remaining twenty per cent to be retained till the completion and final measurement of the work.

It is expressly agreed that no material outside of the limits of the slopes herein provided shall be paid for; and the plan hereto annexed and signed by said Harbor and Land Commissioners and by said parties of the second part shall form the basis of measurement of the work when completed, and be binding upon both parties as the true representation of the existing grade at the commencement of the work.

The party of the first part reserves the right to construct one or more sluice-ways across said street, for the passage of the tide to and from the space west of the same.

It is expressly agreed, that, in the event of the failure of said parties of the second part to complete the said work on or before the first day of July next, the said parties of the second part shall pay to said party of the first part fifty dollars for each and every day beyond said first day of July, until the completion of said work.

In testimony whereof the said Commonwealth has caused its corporate seal to be affixed hereto, and these presents to be signed and delivered in its name and behalf, by its Board of Harbor and Land Commissioners, and the same to be approved by its Governor and Council; and the said Jesse Boynton and Lyman Boynton have hereunto set their hands and seals.

COMMONWEALTH OF MASSACHUSETTS,

[SEAL OF THE
COMMONWEALTH.]

By ALBERT MASON, }
W. P. PHILLIPS, } *Harbor and Land*
FRANCIS A. NYE, } *Commissioners.*

JESSE BOYNTON. [SEAL.]

LYMAN BOYNTON. [SEAL.]

Sales of Back Bay Lands belonging to the Commonwealth from 1857 to 1879 inclusive.

YEAR.	Quantity sold. Square Feet.	Amount.	Average Price per Square Foot.
1857	66,752	\$70,000 00	\$1.048
1858	316,455.5	406,280 53	1.283
1859	6,972	17,430 00	2.500
1860	340,653.5	581,263 71	1.706
1862	40,328	74,351 25	1.843
1863	419,209	871,586 30	2.079
1864	45,797	109,477 65	2.390
1865	59,145	165,925 47	2.805
1866	76,948	136,393 22	1.772
1867	8,848	12,828 48	1.449
1868	42,448	80,164 00	1.888
1869	193,984	384,855 52	1.982
1870	74,776	208,920 20	2.793
1871	172,297	485,093 30	2.817
1872	83,166	284,759 36	3.423
1873	22,960	59,080 00	2.573
1879	114,190.6	359,313 18	3.146
Total	2,084,929.6	\$4,307,722 17	\$2.066

[B.]

REPORT ON REVISION OF HARBOR LINE.

BY HENRY L. WHITING.

To the Honorable Board of Harbor and Land Commissioners of the Commonwealth of Massachusetts.

GENTLEMEN,—In accordance with the request of the Board, I have devised a project of harbor lines for that part of the Inner Harbor of Boston which includes the frontage of the city proper; of Charles River, from West Boston Bridge to the United States Navy Yard; of Fort Point Channel, from Dover-street Bridge to its mouth; and the frontage of the South Boston Flats, including the reclaimed and unreclaimed territory as far as Slate Ledge.

I have made the localities referred to a subject of first consideration, from the fact, mainly, that they embrace the oldest and most firmly established business portions of the city bordering upon the harbor, where change is least likely to be demanded, and where it is least practicable to effect it; and also because these lines of frontage form the best bases for extending the project over localities where, perhaps, a less rigid system of harbor line may be required.

The basin of Charles River above West Boston Bridge has been the subject of recent treatment and change in its harbor lines; and still further modifications are contemplated. It seems, therefore, at this particular time, or until the final purpose and character of the basin is determined, inexpedient to revise the present lines. For similar reasons it seems inexpedient at this time to modify the harbor lines in South Bay above Dover-street Bridge.

A further study and examination of various elements which enter into a proper system of harbor lines applicable to Chelsea Creek and Mystic River require more time and preparation than can now be given to them, in order to lay the results before the Board, together with the project herewith proposed.

For the frontage of East Boston, further data and examination is desirable before a suitable system of harbor lines can be devised, and proper continuity with the lines of Chelsea Creek be effected, as well as to secure a better basis for extending the lines eastward, so as comprehensively to provide for and define the improved frontage contemplated by the East Boston Company and the Boston Land Company.

Without entering into a discussion of the principles of compensation or the complicated physical condition of the harbor, it is important to state that the new harbor line so closely follows the present configuration of the harbor outline, as formed by actual structures,—most of which

have been standing for so long a time that the impressions due to their condition and position have already been effected, — that no physical influences caused by such slight deviations from existing outlines as occur have been taken into account. The project has been based, mainly, upon the adjustment of water-spaces to symmetrical lines of frontage best adapted to navigation and occupation. Where the revised harbor line does deviate from the former line, and from existing outlines, it is for the purpose of correcting irregularities and improving the general alignment of the harbor frontage.

In order that the revised harbor line may clearly and in fact define the *actual limits* of the harbor, it has been so projected that it will in no case fall *within* any *existing structure*, except where it may cross the lines of bridges. In some cases it coincides with the outer faces of wharf structures as they now exist, and many of the initial points or points of deflection in it are coincident with the outer corners of present wharves, and the line has been projected with a view to the extension of other wharf and sea-wall structures to it; and it is desirable, if such structures are so brought out, they should coincide as nearly as practicable with the harbor line, while in no case should they extend beyond it.

A practical difficulty exists in carrying out this system where the frontage is defined by *one line* only, as in the former method, which has seemed to me to be an imperfect one for this as well as other harbors for which I have devised schemes of harbor lines. The question at once arises as to what part of the structures built in conformity to it shall coincide with the harbor line. If the coping, which is generally *understood* to be the line of coincidence in the former system, then all parts of structures having “batter” must extend beyond the line prescribed. If the foundation is the line of coincidence, then structures having unequal batter will present at their surfaces or copings a zigzag and irregular line.

To guard against these objectionable features in the scheme, and provide for the construction of more symmetrical lines within legally prescribed limits, I would respectfully suggest for the consideration of the Board the establishing of *two parallel harbor lines*, to be called the *coping and foundation lines*. The distance between these lines should be governed by the approved batter of frontage structures at a given depth. For the Inner Harbor of Boston that of twenty-three feet at mean low water as the standard depth of channel improvements would seem to be appropriate, or the foundation line may be located beyond the base of ordinary structures, so as to give full room for repairs, &c.; for the water-faces of city proper, and for Charles River and Fort Point Channel, a distance of ten feet between the coping and foundation lines would be sufficient to include all probable structures; for the heavier sea-walls of the South Boston Flats and similar structures, twenty feet would be sufficient. By such a system of harbor lines, a symmetrical surface or coping line can be established at a given elevation, — the coping of the dry dock at the United States Navy Yard in Charlestown would be a suitable plane of reference, — while the foundations and submerged portions of all structures can be constructed within lines which shall *in fact* restrict all

encroachment upon the water-spaces reserved by law for navigation and other harbor purposes.

The loss of initial points and the indefiniteness in direction and extent of the old harbor line are probably largely due to unauthorized encroachments. To guard against the future occurrence of this abuse, it might be well to attach a definite penalty to each transgression of the harbor line, and insert a clause to this effect in the licenses granted.

An important feature in the work is the accurate determination and permanent marking of the points in the harbor line. Experience has proved that reference to local objects, even of apparently stable character, is insecure; and this fact was one of the reasons and requirements for a resurvey of the wharf-lines of the upper harbor, and for basing it upon the costly and perfectly determined triangulation of the United States Coast Survey,—the main points in this triangulation being so securely marked as to preserve them from the probable contingencies of accident. It was also a feature in the scheme of the resurvey to connect each initial point or point of deflection in the harbor line with the points in the harbor triangulation; in fact, to make the points of deflection in the harbor line actual points of triangulation. A practical difficulty, however, arises in the execution of this plan, from the fact that many of the points of deflection in the harbor line will fall in *water*. It became necessary, therefore, to locate and determine by triangulation a point on some actual structure which would be accessible for instrumental occupation, and where local marking could be made as near as practicable to each point of deflection in the harbor line as could not be marked, and to make these points of triangulation "*reference points*" from which the points of deflection in the harbor line could be determined by measured and computed distance and direction. The geographical position of each reference point, and each point of deflection in the harbor line, will be given in tables similar to those for the same class of data published in the last annual report of the Board.

The work of selecting and marking the points in the harbor line has been executed by Mr. William E. McClintock in a most thorough and accurate manner. Each reference point has been located with reference to its future connection with the harbor triangulation; and the observations and measurements referring the reference points to the points of deflection in the harbor line have been made with the same degree of accuracy which has characterized the determinations of the Coast Survey which are the bases of these more minute results. The number of reference points and points of deflection in the harbor line, which have been marked with the copper tacks and iron plates in the manner adopted, amounts in total to sixty-one.

The work of preparing and compiling the larger maps required for the study and project of the revised harbor line has been done by Mr. William T. Blunt in a most accurate and skilful manner. As Mr. Blunt has since left the service of the Board for duty with the Mississippi River United States Commission, I feel it due to him to acknowledge here his energetic and efficient service in connection with this work with the Board.

The only remaining work to be done, in order to make complete the

final determination of the harbor line, is that of the observations and computations connecting it with such points and lines in the harbor triangulation as form the best bases for the results required.

I present herewith the detailed description of the location and marking of the harbor line.

Respectfully submitted.

HENRY L. WHITING.

[C.]

STATEMENT OF OPERATIONS DURING THE YEAR ENDING DEC. 31, 1879, ON WORKS FOR THE IMPROVEMENT OF RIVERS AND HARBORS IN THE STATE OF MASSACHUSETTS, UNDER THE CHARGE OF B'VT. BRIG. GEN'L GEORGE THOM, LIEUT. COL. OF ENGINEERS.

I. — IMPROVEMENT OF BOSTON HARBOR, MASSACHUSETTS.

Operations for the improvement of this harbor by the United States Government have been carried on during the year ending Dec. 31, 1879, as follows: to wit, —

1. Under a contract made June 4, 1877, with Mr. George W. Townsend of Boston, Mass., for the breaking-up and removal of about 290 cubic yards of sunken ledges, situated in the main ship channel at the Upper Middle, and near Kelly's Rock in the outer harbor, the contractor broke up and removed to grade, in the years 1877 and 1878, all the ledges remaining in the main ship channel at the Upper Middle, and about $183\frac{1}{2}$ cubic yards of that near Kelly's Rock, leaving $24\frac{1}{2}$ cubic yards near Kelly's Rock to be removed under his contract. This work was resumed by the contractor on the 1st of May, 1879, and completed on the 12th of June, 1879, to the extent called for under his contract.

2. Under a contract made Aug. 15, 1878, with Mr. Joseph E. Bartlett of Boston, Mass., — the lowest of eight bidders, — for the removal of the Man-of-War Shoal (situated in the upper harbor at the confluence of Charles and Mystic Rivers) to a depth of 23 feet at mean low water by *dredging*, at 27 cents per cubic yard, measured in the scows, the contractor completed about 33,000 cubic yards of dredging on the 15th of December, 1878, when he suspended work for the winter. On the 24th of April, 1879, he resumed work under his contract, and has continued it up to the end of the year 1879, during which period he has dredged about 46,000 cubic yards additional, making a total of about 79,000 cubic yards to date; leaving about 5,000 cubic yards to be dredged by him to complete the removal of that shoal.

3. Under a contract made Aug. 26, 1878, with Mr. Isaac A. Sylvester of Quincy, Mass., — the lowest of three bidders, — for breaking up, and removing to a depth of 23 feet at mean low water, the only remaining sunken ledge near Kelly's Rock (containing $145\frac{3}{4}$ cubic yards, measured *in situ*), operations were commenced by him on the 2d of July, 1879, and continued with much energy until its satisfactory completion on the 7th of November, 1879.

4. The reconstruction of the sea-wall, built in 1868 and 1869, at the

south-east bluff of Lovell's Island, was commenced in June, 1878, and was nearly completed on the 9th of December, 1878, when work was suspended for the winter. It was resumed on the 14th of April, and completed on the 21st of June, 1879. All the stone for this work was furnished by contracts, and all the work was done by hired labor. This sea-wall has been increased in thickness and height, and has had a new granite paving placed in its rear, and a rubble-stone apron built in front for the protection of its foundation; and it is believed that it will now be able to resist the violent storms to which it is exposed, and effectually protect and preserve this part of the island.

5. The sea-walls on Gallop's Island, Long Island, Point Allerton, and Deer Island, have all been repaired where most necessary during the past year.

The appropriation of fifty thousand dollars made by Act of Congress, approved March 3, 1879, for the improvement of Anchorage Shoal, the channel at the Lower Middle, and the upper harbor near the mouth of Mystic River, having been made available therefor by the War Department on the 30th of July, 1879, proposals were at once invited for dredging at those places; and the following contracts were made: to wit, —

6. On the 28th of August, 1879, with the New England Dredging Company of Boston, Mass., — the lowest of two bidders, — for

(a) 38,000 cubic yards, more or less, of dredging at Anchorage Shoal, for obtaining a depth of 23 feet at mean low water, at 74 cents per cubic yard, measured *in situ*; and

(b) 6,000 cubic yards, more or less, at the Lower Middle Shoal, for obtaining same depth as above, at 84 cents per cubic yard, measured *in situ*.

Operations were commenced at Anchorage Shoal, under this contract, on the 15th of September, 1879, and were continued up to the 17th of December, when they were suspended for the winter; resulting in 9,937 cubic yards of dredging *in situ* to that date, whereby the channel has been opened to the required depth for a width of about 350 feet.

7. On the 11th of September, 1879, a contract was made with the New England Dredging Company of Boston, Mass., — the lowest of four bidders (after proposals had been twice invited for the work), — for 50,000 cubic yards, more or less, of dredging in Mystic River, near its mouth, for obtaining a depth of 23 feet at mean low water, at 33 cents per cubic yard, measured in the scows. Operations were commenced under this contract on the 2d of October, 1879, and have been continued up to the close of the year, resulting in about 26,000 cubic yards of dredging under said contract.

The dredging to be done at Anchorage Shoal under the present contract (*viz*, 38,000 cubic yards, more or less, measured *in situ*) will open a channel of the projected depth to a width of about 600 feet; whereas the full width projected is to be not less than 1,000 feet, which will require about 80,000 cubic yards of additional dredging.

The dredging contracted for at the Lower Middle Shoal (to wit, 6,000 cubic yards, more or less, measured *in situ*) will open the channel at that place to the full projected width of not less than 650 feet.

The dredging contracted for in Mystic River (to wit, 50,000 cubic yards, more or less, measured in scows) will open a channel of the projected depth to a width of about 100 feet throughout the whole length of the shoal; whereas the full width projected is 300 feet.

From the foregoing statement, it is seen that the work that now remains to be done under the present contracts consists of—

1. The completion of the contract made Aug. 15, 1878, with Mr. Joseph E. Bartlett for the dredging at the Man-of-War Shoal, of which about 5,000 cubic yards now remains to be done.

2. The completion of the contract made on the 28th of August, 1879, with the New England Dredging Company for the dredging at Anchorage Shoal, of which about 28,000 cubic yards remains to be done; and about 6,000 cubic yards of dredging at the Lower Middle Shoal.

3. The completion of the contract made Sept. 11, 1879, with the New England Dredging Company for the dredging at Mystic-river Shoal, of which about 24,000 cubic yards now remains to be done.

The work that has been *completed* up to the 1st of January, 1880, for the improvement of this harbor, consists of the following: viz.,—

- I. The main ship channel has been straightened, widened, and deepened, so as to have a width of not less than 600 feet, and a depth of 23 feet at mean low water at the following places: viz.,—

1. At the west end of Great Brewster Spit.
2. At the south-east and south-west points of Lovell's Island.
3. At the Upper Middle Bar.

Whereby this channel, from the entrance of the lower harbor up to Anchorage Shoal, has a width of not less than 600 feet, and a depth of 23 feet at mean low water (or about 32½ feet at ordinary high water), except at the Lower Middle, where it requires widening.

- II. *Sea-walls* have also been built, for the preservation and protection of the headlands in the harbor, at Point Allerton, Great Brewster Island, Lovell's Island (north and south-east heads), Gallop's Island, Long Island (north head), Rainsford Island, and Deer Island (north, middle, and south heads); which are now generally in good condition.

- III. *Sunken rocks* have also been broken up and removed as follows: viz.,—

Kelly's Rock and all the known sunken ledges near it, Tower Rock, Corwin Rock, the ledges recently discovered at the west end of Great Brewster Spit, and between there and George's Island (all situated in the main ship channel at "the Narrows"), to a depth of 23 feet at mean low water. Barrel Rock in Broad Sound, State and Palmyra Rocks, situated about one-half a mile east of Castle Island, have also been removed.

Surveys and estimates have also been made, and appropriations asked, for completing the following additional work now projected for the improvement of this harbor:—

1. For completing to a least width of 1,000 feet the main ship channel at Anchorage Shoal	\$60,000 00
2. For completing to a width of 300 feet the main ship channel in Mystic River, in the upper harbor	35,000 00
3. For straightening, widening, and deepening the main channel in the upper harbor, from the mouth of Charles River up to Western-avenue Bridge, and thence up to the head of tide-water at Watertown	74,600 00
4. For the repairs of the several sea-walls built for the preservation of this harbor	5,000 00
Adding for engineering expenses and other contingencies, say,	20,400 00
Total	\$195,000 00

II. — MERRIMAC RIVER, INCLUDING THE HARBOR OF NEWBURYPORT, MASSACHUSETTS.

I. *Merrimac River above Newburyport, Mass.*—Under the appropriation of five thousand dollars made by the River and Harbor Act of March 3, 1879, the improvement of this river has been continued at the falls between Haverhill and Lawrence, Mass., under an arrangement made with the Pentucket Navigation Company, by which, since the 1st of September last, the channel at the Upper Falls has been straightened and widened, and in some measure improved at the Lower Falls. Numerous sunken bowlders have also been removed from the river at the Upper Falls, Lower Falls, Hazeltine Rapids, and below. The only projected work that now remains to be done at these falls is the removal of a sunken ledge at the Lower Falls, which it is contemplated to have done next season with the funds now available therefor.

By these improvements at the falls, the channel will have 3 feet of water up to the head of tide-water at the foot of the Upper Falls in the lowest stages of the river, at *low tide* with the mill-water at Lawrence *not* running, and about 5 feet of water with the mill-water *running*; whilst at *high* water, with the mill-water *running*, there will be about $7\frac{1}{2}$ feet of water. At the Upper Falls (above tide-water) the channel (as now completed) has a depth of about $4\frac{1}{2}$ feet in the lowest observed stages of the river with the mill-water *running*.

The following work has also been done (in the years 1870–78) for the improvement of this river: viz., (1) the rocky shoals dredged, and numerous sunken bowlders removed from the channel, at and near Rock's Bridge (six miles and a half below Haverhill), including Currier Rock above, and Petty Rock below, the bridge,—greatly improving this the most dangerous part of the river below Haverhill; (2) the channel opened by dredging, for a width of 100 feet, to a depth of 12 feet at ordinary *high* water, at Currier's Shoal (about four miles below Haverhill); (3) also, to the same depth and for a width of 75 feet, at the shoals near the head and foot of Silsby's Island (about one mile below Haverhill); (4) and at Haverhill the shoal between the two bridges has also been improved by dredging, so as to have a channel 10 feet in depth at ordinary high water. The above improvements comprise all that have hitherto

been projected for this river below Haverhill, with the exception of the removal of some more bowlders at Rock's Bridge, for which an appropriation of one thousand dollars has been asked.

2. *Newburyport Harbor, Mass.*—Under the appropriation of ten thousand dollars made by the River and Harbor Act of June 18, 1878, a contract was made Aug. 10, 1878, with Mr. Isaac A. Sylvester of Quincy, Mass.,—the lowest of five bidders,—for breaking up, and removing to a depth of 9 feet at mean low water, 300 cubic yards, more or less, of the North (Gangway) Rock, at \$28 per cubic yard, measured *in situ*. Work was commenced under this contract on the 24th of August, 1878, and continued up to the 20th of December, when it was suspended for the winter, during which period about 170 cubic yards of the ledge was broken up, and removed to grade. Operations were resumed by the contractor on the 16th of April, and completed on the 28th of June, 1879, in which time $135\frac{4}{10}$ cubic yards of the ledge was removed to grade, making a total of $305\frac{4}{10}$ cubic yards removed under and in completion of his contract. By this work the channel has an increased width of 60 feet for a depth of 9 feet at mean low water.

In the year 1870 Gangway Rock (situated about 70 yards to the south-east of North Rock) was for the most part reduced to the same grade,—to wit, 9 feet below the plane of mean low water; and the sunken wreck of the schooner "Globe" was also removed.

The additional work projected for the improvement of this harbor consists of (1) removing to grade still more of North Rock, so as to increase the channel 20 feet more in width for a depth of 9 feet at mean low water; (2) completing the removal, to the same grade, of Gangway Rock; (3) the removal, to the same grade, of South Gangway Rock, situated about 120 yards to the south-east of North Rock; (4) breaking up and removing the ledge in the upper harbor, known as "the Boilers," to a depth of 5 feet at mean low water; (5) removing four sunken piers from the channel near the entrance of the harbor abreast of Black Rock's Creek; (6) removing a large sunken bowlder from the channel between the north and south piers. The estimated cost of these improvements is twenty-three thousand dollars, for which an appropriation has been asked; making a total of twenty-four thousand dollars asked for both river and harbor.

III. — PLYMOUTH HARBOR, MASSACHUSETTS.

By the River and Harbor Act of June 18, 1878, the sum of five thousand dollars was appropriated for the improvement of this harbor, about half of which was expended, in 1878, in the extension of the stone bulkhead at the outer end of Long Beach, and in the repairs of other works on that beach where most necessary. This work was resumed in June, and was completed in November, 1879, for a length of about 700 feet along and outside of the wooden crib-work bulkheads, now much impaired by age and storms. This bulkhead, as extended, will give better and more permanent protection to the outer end of the beach.

During the past year all the necessary repairs have been made, and all

the works on the beach are now in a good, effective condition; but, exposed as they are to injury from violent easterly storms, they will necessarily continue to require occasional repairs. These works have been built, from time to time, for the protection and preservation of Long Beach, upon the existence of which this harbor depends. They consist of bulkheads, jetties, and groins, built for the accumulation of sand; and the planting of beach-grass, also to accumulate sand and give permanency to the beach thus formed, whereby a ridge has been formed throughout the whole extent of the beach, which is for the most part covered with beach-grass.

For the improvement of the harbor itself, the sum of ten thousand dollars was appropriated by the River and Harbor Act of March 3, 1875, by which a channel was opened from the Middle Ground up to Long Wharf, a distance of about 2,500 feet, to a depth of 6 feet at mean low water (or 16 feet at mean high water), and for a width of 50 feet.

The project originally provided for a channel, 100 feet in width, to be extended southward to the mouth of Town Brook, a distance of about 900 feet above Long Wharf, so as to form a basin in front of the wharves of the city, 125 feet in width, with a depth of 8 feet at mean low water.

For the completion of this project, the additional sum of twenty-five thousand dollars was asked in my annual report to the Chief of Engineers for 1878, since published by Congress. By the River and Harbor Act of March 3, 1879, the sum of thirty-five hundred dollars only was appropriated for this work; but it has been decided to wait for an additional appropriation before doing any thing further towards its completion.

IV. — PROVINCETOWN HARBOR, MASSACHUSETTS.

All the works projected for the preservation and improvement of this harbor have been completed, except the extension of the stone bulkhead on Long Point. These works are now in good condition, and fully answer the purpose designed. They will, however, require continual watching and occasional repairs, for which purpose an additional appropriation of one thousand dollars has been asked.

Under the appropriation of one thousand dollars, made by the River and Harbor Act of March 3, 1879, $544\frac{480}{2240}$ tons of rubble-stone has been placed on the bulkhead on Long Point, in extension of the same, during the past season.

[D.]

STATEMENT OF OPERATIONS DURING THE YEAR ENDING JUNE 30, 1879, ON WORKS FOR THE IMPROVEMENT OF RIVERS AND HARBORS IN MASSACHUSETTS, UNDER THE CHARGE OF B'VT. MAJ. GEN'L. G. K. WARREN, LIEUT. COL. OF U. S. ENGINEERS.

WOOD'S HOLL HARBOR.

Surveys of this harbor were made in 1873 and 1878, and fifteen thousand dollars appropriated by Congress for dredging and improving its channels. It is understood that considerable work has been done in removing rocks and bowlders since the report of Gen. Warren was made up.

TAUNTON RIVER.

Two thousand dollars appropriated by Congress in June, 1878, has been expended during the succeeding fiscal year in the removal of 232 cubic yards of bowlders from the channel between Weir and Dighton, a distance of six miles.

ANNUAL REPORT

OF THE

HARBOR AND LAND COMMISSIONERS,

FOR

THE YEAR 1881.

BOSTON:

Rand, Avery, & Co., Printers to the Commonwealth,

117 FRANKLIN STREET.

1882.



Commonwealth of Massachusetts.

HARBOR AND LAND COMMISSIONERS' REPORT.

To the Honorable the Senate, and the House of Representatives of the Commonwealth of Massachusetts.

THE Board of Harbor and Land Commissioners, in accordance with the provisions of law, respectfully submit their Annual Report for the year 1881.

SOUTH BOSTON FLATS.

The reclamation of land lying easterly of that heretofore sold to the Boston and Albany Railroad Company and to the New York and New England Railroad Company has made good progress during the year. About two hundred and fifty thousand yards of material dredged from the harbor under operations of the General Government and of private parties have been deposited on the flats lying immediately east of B Street. This has been accomplished at very small expense to the Commonwealth for the construction of bulkheads to retain the filling and for superintending the dumping.

Only a small quantity of material has been deposited under the contract of Aug. 28, 1880, with Thomas Potter, for three hundred thousand cubic yards; but the contractor promises that the entire quantity shall be deposited before Jan. 1, 1883, the time required by the contract.

Under the appropriation of five hundred thousand dollars made last year, the Board decided to obtain as much filling as practicable, using no part of the appropriation for the con-

struction of piers. Several considerations operated to lead to this decision. By prosecuting the filling as rapidly as possible, the removal of the remainder of the shoal lying in front of the territory already reclaimed will be accomplished at the earliest time practicable. The filling required must be done before any piers which could be constructed would be available for use, and the filling is of necessity a slow process. The great advance which has been made in appliances for the transaction of large business warns us that it must not be assumed that this advance has ceased. Piers and docks planned to meet the most approved methods of to-day might not be all that would be demanded five years hence, and the special needs of those who shall occupy the premises must largely determine what will be required for docks and piers.

A contract was made in August with the New England Dredging Company to dredge and deposit upon the flats to be reclaimed nine hundred thousand cubic yards of material within four years from the approval of the contract. Work was begun immediately under this contract, and is progressing satisfactorily. It will require the removal of only seven hundred thousand cubic yards to take away all that remains of the shoal lying between the channel in front of the reclaimed territory and the main channel, and give twenty-three feet depth at mean low water from East Boston piers to South Boston sea-wall. On the completion of the two contracts now in progress, this depth will be secured, twelve or thirteen hundred feet easterly of what is known as the fifty-acre piece, covering all the frontage now reclaimed and all that will be reclaimed by the material obtained from this dredging. The material obtained under the Potter contract is being deposited next easterly of the fifty-acre piece, and will raise to grade thirteen an area of about fifteen acres; that obtained under the contract with the New England Dredging Company is being deposited, a part immediately easterly of the area covered by the Potter contract, and a part in the rear of this and of the Potter area, and will raise to grade thirteen a further area of about forty-three acres. The area lying between the last-mentioned area and the present line of riparian ownership comprises about thirty-seven acres, and is likely to be filled from miscellaneous sources already mentioned by the time the filling in front is com-

pleted. The filling under the Potter contract and the New England Dredging Company contract is all placed south of a bulkhead erected thirteen hundred feet in rear of the front line of occupation, leaving ample room for the construction of docks and piers twelve hundred feet long. The area left for docks and piers comprises about forty acres, making a total of one hundred and thirty-five acres available for occupation when these are constructed.

The contract with the New England Dredging Company amounts to \$434,000, which with the minor contracts for bulkheads, the completion of B Street, engineer and other expenses attending execution of the work, will substantially exhaust the existing appropriation; but it is not now seen that there would be advantage in entering upon other contracts of importance the ensuing year.

There are still some fractional interests in the area which the Commonwealth attempted to purchase between B and E Streets under the provisions of chap. 446 of the Acts of 1869, which are not yet acquired. $\frac{3}{8}$ of one lot and $\frac{1}{7}$ of another are outstanding. At the price paid for the interests purchased, these outstanding interests amount to \$5,234. The original appropriation having expired, a new appropriation of ten thousand dollars was made by resolve, chap. 61, of 1877, but limited so that no part of the appropriation could be used unless all the outstanding interests were secured. The larger interest could be secured on the same terms as those already purchased, but the smaller could not. Two years later, by chap. 170 of the Acts of 1869, it was provided that three thousand three hundred dollars might be used. This would have been sufficient to have purchased the larger outstanding interest; but during the delay litigation had arisen between the owner and a mortgagee, which suspended negotiation, and the appropriation again expired. The Board recommend a renewal of the appropriation made by the Act of 1877, but without the limitation which imposed the necessity of acquiring all or none.

A contract has been made with the New York and New England Railroad Company for covering B Street with gravel at fifty cents per cubic yard, and the tracks are laid for the execution of the work.

BACK BAY LANDS.

		FEET.
In 1857 the Commonwealth owned on the Back Bay .		4,723,998
Of which there have been donated	363,308	
Devoted to streets and passage-ways	2,037,068.60	
Sold as per last report	2,195,789.05	
Sold in 1881	25,238.75	
	<u>2,221,027.80</u>	
Remaining for sale Dec. 31, 1881	102,593.60	
		<u>4,723,998</u>
The gross proceeds of land sold as per last report		
	\$4,623,087 02	
The gross proceeds in 1881	83,549 75	
	<u>\$4,706,636 77</u>	
Rights in Parker Street as per last report		2,300 00
		<u>\$1,708,936 77</u>
Cost of filling, grading, etc., as per last report		
	\$1,626,008 71	
Cost of auction sales as per last report	14,291 78	
	<u>\$1,640,300 49</u>	
Net proceeds to Dec. 31, 1881		\$3,068,636 28
There has been sold in 1881 as follows:—		
2,800 feet Marlborough Street, north side, for	\$11,200 00	
3174 $\frac{3}{4}$ feet Commonwealth Avenue, south side	15,873 75	
19,264 feet Newbury Street, north side	56,476 00	
	<u>\$83,549 75</u>	

The average price per foot obtained was \$3.31, the lowest price \$2.75, and the highest price \$5.

The sales have been much less than last year; but there has been no decrease in prices, and the amount of land remaining unsold is so small that no apprehension is felt that as good prices will not be obtained for all that remains.

The land unsold is located as follows:—

Marlborough Street, north side	16,777.6
Commonwealth Avenue, south side	3,237
Newbury Street, north side	12,320
Newbury Street, south side	26,208
Boylston Street, north side	36,176
Boylston Street, south side	7,875
	<u>102,593 6</u>

The value of the remaining land cannot be less than \$250,000.

By chap. 185 of the Acts of 1875 for the laying-out of public parks in or near the city of Boston, it was provided that any real estate in the city of Boston, which in the opinion of said Board shall receive any benefit and advantage from the locating and laying-out of a park under the provisions of this Act, beyond the general advantages to all real estate in the city of Boston, may, after like notice to all parties interested as is provided by law, to be given by the street commissioners of the city of Boston in cases of laying out streets in said city, be assessed by said Board for a proportional share of the expense of such location and laying out; provided, that the entire amount so assessed upon any estate shall not exceed one-half of the amount which said Board shall adjudge to be the whole benefit received by it. The terms of this provision are certainly sufficiently general and sweeping to include the State House and all the land of the Commonwealth, if no exception is implied. The principle that the property of the Commonwealth is exempt from taxation independent of statute exemptions has been long established, and applied by the court of last resort to taxation for local improvements of a public nature as well as to taxation for general public purposes (116 Mass., 193); and, if the Legislature had intended that the general language of the statute should be construed to include any land of the Commonwealth, it would probably have provided that some agent of the Commonwealth should have authority to pay the assessment on such land. The failure to make such provision, and the fact that the only method of collection provided was by sale of the land assessed, would seem conclusive that it was not intended to make an exception to the general principle, were it not that a different view has been taken by the commissioners acting under the statute, and assessments have been actually made upon land of the Commonwealth on the Back Bay amounting to \$13,495.75. More than half this amount was assessed upon land which had been bargained by the Commonwealth before the park was laid out, and which the Commonwealth was under obligation to convey at a price fixed, and which could not be increased by reason of any effect of the park. Legal proceedings have been instituted by the Attorney-General to test the validity of these assessments, and it is probable that no legislation

will be required. It is proper, however, that the matter should be brought to the attention of the Legislature. If the Commonwealth had not contributed otherwise to the construction of the parks of the city, it might be said that the same equity existed for subjecting the vendible lands of the State to assessment for park construction as existed for subjecting land of citizens to such assessments; but on consideration of all the facts it will be seen that the Commonwealth will not have been wanting in liberal action toward the parks if the general principle so unquestionably sound is allowed to operate undisturbed. By chap. 92 of the Acts of 1881 the Commonwealth authorized the use for park purposes, under the Act of 1875, of 133,400 feet of land lying in Charles River Basin, the money value of which was many times the amount of the assessments in question. By chap. 247 of the Acts of 1866 a grant was made to the city of Boston for similar purposes, though of less extent.

TIDE-LANDS.

There has been received during the year, for land of the Commonwealth occupied by wharves and other structures in tide-water, the sum of \$58,663.75. This amount is much larger than has been received in any previous year since the passage of the Statute of 1874 under which these sums are received.

HARBOR LINES.

In the reports of the Board for 1878 and 1879, the subject of harbor lines for the inner harbor of Boston was presented; and in the latter report, 1879, a scheme was submitted and a description prepared of a series of lines along the frontage of the city proper, from Dover-street Bridge to West Boston Bridge, and of the westerly side of Charles River from West Boston Bridge to the Navy Yard. These lines, as reported and described, were afterwards, by chap. 170 of the Acts of 1880, established as harbor lines.

In accordance with the original intention and general plan proposed, the Board has made a further study and prepared a scheme of lines for the frontage of East Boston from Meridian-street Bridge on Chelsea Creek to Pier No. 4 of the Grand Junction Wharves on the northerly side of the main basin of the inner harbor. A detailed description of these lines is given below.

In confining the project now submitted to the portion of the harbor frontage included within its range, the Board has been guided by considerations of public interest in prescribing lines for those parts of the harbor where improvements and the development of the business occupation of the frontage required the direction and limitation of proposed and progressing structures.

The south-easterly frontage of Charlestown and the westerly side of Chelsea Creek are already well defined by the substantial sea-walls of the United States and those built by the Mystic River Improvement Company. The former have been long in place, and the latter conform to established harbor lines which require no re-statement.

No commercial exigency demands an immediate revision of that part of the frontage of the city of Chelsea lying between Chelsea and Meridian-street Bridges. This part of the water-front of the harbor may, however, require future modification; but it should be made in connection with a comprehensive study of the physical and commercial and economic capabilities of the Mystic River above Chelsea Bridge and of Chelsea Creek above Meridian-street Bridge. The Board has not yet had opportunity (nor means) to make the necessary examinations and surveys upon which such a study should be based, and therefore presents, at this time, no scheme therefor.

In their last Annual Report the Board gave a brief account of the imperfect condition of the harbor line of East Boston, with some explanation of the causes which had led to it, and expressed the opinion, that, while some of the wharves extended beyond the present harbor line, others might be extended without injury to the harbor, and at the same time afford additional commercial facilities of value to the port. A remedy for these defects was suggested, or a mode of dealing with special cases like that of the Boston and Albany Railroad Company, which seemed to the Board a safe and practicable one. No action was taken, however, upon these suggestions; and the difficulties of the situation will be only in part removed by the revision herein recommended: but the Board deem it inexpedient to revise the harbor lines eastwardly beyond Pier 4 of the Grand Junction Wharves at the present time. Legal notice was given, and a hearing

appointed upon the subject of defining the line of frontage between the locality above named and Point Shirley. The hearing was quite fully attended, and large landed and commercial interests were represented. The Board had previously prepared, in their office, a preliminary plan for the general development of this ground; but no other scheme was offered, or plan presented, with which any proper adjustment could be effected, or which harmonized with the present views of the Board. Their experience has proved the value of careful deliberation and cautious action in dealing with schemes which will require long periods of time for execution. The study of such subjects includes, not only perfecting provisional plans for the preservation and improvement of the natural features and functions of a harbor, but often involves important questions of *change*, in regimen and otherwise, which are the more difficult and critical to determine properly. The numerous islands and extensive flats and shoals, and the many natural channel-ways between them, which characterize Boston Harbor, particularly the northeastern part of it, offer favorable ground for treatment; but it should be dealt with in the most judicious and comprehensive manner. The want of plan and system, in much that was done before organized supervision was established, resulted, not only in the imperfect utilization of many natural advantages, but in serious and irreparable injury.

In determining the scheme of the South Boston Flats improvement, the best available advice was sought, and the best practicable data obtained concerning it. The surveys upon which the outline of the project of improvement was based cost many thousand dollars, and the study of the problems involved was the work of many years. The wisdom of this course has been fully proved by the success of each stage of progress in the work.

Of not less importance, physically and commercially, is the line of frontage, with its outlying flats, between East Boston and Point Shirley. This ground presents many advantageous features, and ample space exists for the location of extensive docks by taking advantage of the natural depths and channel-ways. A scheme for the proper development of this portion of the harbor is a project of about equal magnitude to the South Boston Flats improvement.

The improvement of the frontage between Castle Island and Commercial Point would be also a great addition to the maritime business territory of the port. This line of frontage would be somewhat more exposed than the East Boston and Point Shirley side; but the ground naturally admits of docks of any desirable magnitude, with extensive flats and marshes in the rear, which can be filled and utilized for commercial purposes. These lines of frontage on either side of the harbor are each open to approaches by the main channel below the harbor "middle grounds," and each have direct communication with the anchorage of President Roads. With comparatively slight dredging these lines of frontage will afford a general depth of fifteen feet at mean low tide, and on portions of each line a depth of from twenty to twenty-three feet can be obtained.

Much has been said on the subject of artificial docks in connection with the improvement of Boston Harbor, using this term to designate enclosed basins, which may have within their limits a number of single slips; but no such work seems to be needed. The main inner basin is a natural dock of itself. In fact, the area of sheltered water, as an inner harbor, is of much larger extent than the community in general are aware. The term "inner harbor" is generally applied to the smaller basin above Governor's and Castle Islands and below the bridges, which contains, within the limits of projected improvements, about 1,150 acres. But what is really the *inner harbor*, or may be properly so regarded, is the general area which comprises the water-spaces, including this upper basin, which are enclosed and protected by the high grounds of East Boston and Winthrop on the north, Deer Island and Long Island on the east, and Spectacle Island, Moon Head, and Squantum, on the south, — a nearly land-locked basin, capable of an improved area of not less than about 6,300 acres. This includes President Roads, which in itself contains nearly one thousand acres of anchorage ground of the *first order* as to depth of water (twenty-three to fifty feet at mean low tide), "holding-ground," and shelter. The width of entrance (between Deer Island spit and Long Island head) to this larger inner basin is less in proportion to the water-space enclosed than the entrance to the smaller basin above. It has a natural depth of over fifty

feet, while the entrance to the upper basin has had to be artificially deepened by the General Government to twenty-three feet. The area of this larger portion of the inner harbor, exclusive of the 1,150 acres above Governor's and Castle Islands, is about 5,150 acres. The examination of any approximately accurate chart of Boston Harbor will show at once the relative proportions, situation, and surroundings of the respective water-spaces.

Various opinions have been expressed concerning some of the features of the upper basin, particularly in regard to Bird Island shoal and the channel or water-way between it and the south-easterly point of East Boston. The Board are not in possession of sufficiently recent or accurate data to speak unqualifiedly in regard to these natural features. The channel-way just referred to was not considered by the United States Advisory Council for Boston Harbor of marked physical importance; nor is it one which can be used for even second-class navigation, as required to-day. Nature has determined the main inlet of this upper basin to be between Governor's and Castle Islands, where it has established a depth, in the narrower or more contracted section, of about twenty-seven feet at mean low tide. Its second natural pathway of flowage is between Bird Island shoal and Governor's Island, where it has established a depth at its narrowest section of about twenty-nine feet, with a least depth in the shallowest section of this lateral channel of about sixteen feet. The third inlet or water-way in point of natural consequence is the one above referred to, between Bird Island shoal and the main shore of East Boston, where nature has established a depth of but $9\frac{1}{2}$ feet at mean low tide. How far it may affect the regimen and physique of the harbor to widen and deepen this third-rate channel-way, and to what extent it may be done and not imperil the other channels, particularly the one upon which the General Government has expended so much time and money to improve, are questions of grave importance, which can only be solved by careful study and the calculation of the forces which may affect them.

With regard to the removal of Bird Island shoal by dredging, the scheme in the present opinion of the Board has many serious objections. The shoal answers now as a break-water in strong northerly and north-easterly winds, and pre-

vents what might be an injurious sea-dash upon the quay of the South Boston Flats. The southerly margin of the shoal is quite abrupt, and maintains a remarkable parallelism with the line of the South Boston quay, and exercises with it an important function in confining and directing the tidal currents in their inflow and outflow through the main channel.

The amount of space gained to the area of the upper basin by the removal of Bird Island shoal does not seem to be commensurate with the labor and cost of effecting it. It can hardly be said to be a necessity. The width of the basin between a line which may be made a line of frontage, similar to the South Boston Flats, and the quay of these flats, is about three thousand feet, which is about the same as the width of the Mersey in front of the great docks of Liverpool. The material of this shoal is *solid ground*, and in its natural state capable of sustaining the weight and pressure of any desired structure.

In the rear of Bird Island shoal and between it and Governor's and Apple Island and the main shores of East Boston and Winthrop, is a depressed area of flats traversed by three of the minor channel-ways which characterize this portion of the harbor. In this locality a basin six thousand by five thousand feet square, more than a square mile of area, can be created by the removal of less material, to the space and depth acquired, than would be necessary in any other part of the inner harbor where it could serve like purposes. Such a basin can be so located as to make the outline of at least two of its sides coincident with lines of commercial frontage of the first order.

There is probably no other harbor known to commerce which, in its natural conditions of configuration, marginal ground, basins, channels, entrance, and shelter, is capable of affording equal facilities in so concentrated a manner as the main inner basin of Boston Harbor. It is in general form a hollow square, on each available side of which natural channels mark natural lines of frontage of such a character that docks and piers can be constructed along these lines of any size and depth of approach and berth capacity within the range of the most diversified requirements and with a degree of economy and mechanical facility unparalleled in harbor qualifications. As before stated, these inner harbor basins

contain an area of about 6,300 acres. The preliminary plan prepared by the Board to illustrate the possibilities of the harbor shows that a simple and systematic arrangement could be effected for a series of docks 1,000 feet long and 300 feet wide with alternate piers of equal length and 250 feet wide. The quay of the South Boston Flats between Fort Point Channel and Castle Island admits of twenty such docks and twenty-one such piers, including those already built and in progress of building. According to the plan referred to, a quay can be projected, parallel to that of the South Boston Flats, extending from the termination of the present harbor line at East Boston in the alignment of and coincident with the southerly margin of Bird Island shoal to the abrupt, deep channel which marks its easterly limit. Along this line of frontage five docks and six piers can be provided, and along the southerly face of the shoal about 2,300 feet of quay can be extended; and upon the higher and firmer parts of the shoal the heaviest elevators can be constructed without uncertainty or excessive cost as to foundation. Along the line of quay the largest vessels could have ample berth. From the south-easterly point and termination of this quay a line of frontage at right angles with it can be extended northward along and coincident with the margin of the deep natural channel between Bird Island shoal and Governor's Island to a point in the general alignment of the northerly side of the natural channel which trends nearest to and is most nearly parallel with the shore line of Winthrop. Along this north-and-south line of quay, twelve docks and thirteen piers can be provided. From the northerly limit of this last-named line, and again at about right angles to it, a direct line of frontage can be extended to Point Shirley, along which seventeen docks and eighteen piers can be provided. This estimated number of docks and piers is exclusive of these already existing and in use, excepting those on the South Boston Flats. It is within the angle of these lines of frontage that a basin can be defined and excavated, as previously suggested; and such a basin should be an inseparable part, and is an absolutely necessary factor, in the development of first-class harbor facilities. It is a sacrifice of advantage in the treatment of such ground to extend fillings or excavations on either hand in excess of just that

equilibrium which is the measure of the most economical adjustment of terminal lands with approaches and access to them by channels and basins.

To recapitulate, it will be seen by such a general plan as the Board prepared as a preliminary study, that the total capacity of these remarkable basins within perfectly practicable means of accomplishment is about as follows : —

	DOCKS. PIERS.	
South Boston quay	20	21
East Boston south quay	5	6
East Boston east quay	12	13
Winthrop quay	17	18
	<hr/> 54	<hr/> 58

Each of these docks, as projected on the plan referred to, is estimated as capable of holding four first-class steamers of the present day, and the alternate piers to accommodate their shipping. It will be seen, therefore, that Boston can be made capable of receiving at one time within her port *two hundred and sixteen* of the largest vessels now afloat. There are no natural or practicable difficulties in making most of the docks suggested longer, wider, and deeper than has yet been contemplated. In fact, they can be so located and constructed that any steamer of any size or draught within the probabilities of construction can have berth accommodation and facilities. While the heavier vessels of the present time have now to wait in the open sea for the tide to lift them over the bars of New York and Philadelphia, they can pass into Boston Harbor without detention and without fear. By taking advantage of a channel not generally used, — the “Hypocrite Channel,” between Green and Calf Islands, — a depth of *forty feet* at mean low tide can be carried up to and into President Roads.

Unlike the long extended single line of frontage made necessary by the occupation of river-sites, like the Mersey and the Hudson, where the separation of business centres amounts to miles, the extreme extents of frontage in Boston Harbor, in its form of a hollow square, can be appropriately given in *feet*. The extent of what may be called the southerly basin, along its southerly face from the quay of the city to Castle Island, is about 10,200 feet, equal to about $1\frac{9}{10}$ miles. The north-

erly side, from the south-westerly point of East Boston to the south-easterly point of Bird Island shoal, is about 6,800 feet equal to about $1\frac{3}{10}$ miles. The width of this basin between these parallel quays is about three thousand feet. The easterly water-face of East Boston, according to the plan referred to, is about 7,500 feet, equal to about $1\frac{42}{100}$ miles. The line of frontage along the water-face of Winthrop is about 9,100 feet, equal to about $1\frac{7}{10}$ miles. The distances between extreme points in the general extent of the inner harbor are about as follows : —

	MILES.
From the mouth of Fort Point Channel to Point Shirley, the longest distance from north-east to south-west extremes . . .	4
Mouth of Charles River to Castle Island	3
City quay to Castle Island	$2\frac{1}{2}$
City quay to south-east point of Bird Island	$1\frac{3}{8}$
North-west angle of northerly basin to centre of city quay .	$2\frac{1}{4}$
North-west angle of northerly basin to Castle Island . . .	$2\frac{1}{4}$
North-west angle of northerly basin to Point Shirley . . .	2
Point Shirley to Castle Island	$2\frac{1}{3}$
Northerly quay of northerly basin to southerly quay of southerly basin, through what may be called Bird Island Channel, — width of southerly basin, — about (3,000 feet) . .	$\frac{57}{100}$

It will be seen, therefore, that the improvement and utilization of the harbor is a work of great magnitude, and as great importance, in the development of which the interests and responsibilities of the Commonwealth demand vigilant supervision.

While it may be unwise to impose too restrictive measures upon private enterprises, no scheme or plan of limited or special purpose should be allowed to prevent or injuriously affect the future development of more important public advantages. It may be and probably is impracticable to repair past injuries, but with acquired experience and better knowledge it would be *inexcusable* if gross mistakes should again occur.

The Board desire to emphasize the doctrine that no scheme of individual or corporate device should be permitted to prevail that is not in accord with the broadest view of the public claim and interest in the harbor.

It may not be out of place in this connection to quote from one of the unpublished able reports of Prof. Henry Mitchell,

of the United States Advisory Council for Boston Harbor, addressed to the Board of Harbor Commissioners when the subject of the protection of the headlands of the harbor was under consideration. Prof. Mitchell says, —

“The great merit of Boston Harbor lies in a happy conjunction of many favorable elements, among which we may distinguish as most important the facility and safety of its approaches, the ample width and depth of its entrances, and, above all, the shelter and tranquillity of its roadsteads. Perhaps there is no other harbor in the world where the inlets from the ocean are better adjusted to the amplitude of the interior basins, or whose excellent holding-grounds are so easy of access and yet so land-locked. I quote from the highest authority in my profession when I declare that the primary requisite for a good harbor is that ‘*the internal area should bear such a relation to the width of entrance as to produce a sufficient degree of tranquillity*’* And so difficult has it been to properly adjust this relation in artificial harbors, that nearly one-half of all these works may be set down as failures, because the entrances are either too narrow to admit vessels under trying circumstances, or the interior reservoirs too small to dissipate the waves that run in from the sea. In natural harbors, where the primary requisite, cited above, is fulfilled, it often happens that the interior basin is so large that the local effects of strong winds are sources of discomfort and even danger, as in San Francisco. Boston Harbor has no such drawbacks; her interior water-space is large, but is divided by chains of islands into basins which offer sufficient room for the heaviest ships to ride freely at anchor, and sufficient tranquillity for the frailest fishing-boat.

“There are times when shelter from the wind is scarcely less important than smooth water. In the harbor of Cherbourg the in-run of the waves is most effectually arrested by the great mole, and yet nearly every vessel that sought shelter in the gale of 1865 was driven on shore by the wind. Here again Boston Harbor claims peculiar advantages: her moles are promontories and islands rising from twenty to one hundred feet above the sea.”

The following is the re-statement of the harbor line of East Boston, from Meridian-street Bridge to Pier No. 4 of the Grand Junction Wharves. The particulars of the re-statement are not in precisely the same form and terms as those of the harbor line of Boston city; but the data given are more concise than that first submitted.

* Stevenson on Harbors.

DESCRIPTION OF EAST BOSTON HARBOR LINE FROM MERIDIAN-STREET BRIDGE TO PIER 4 OF THE GRAND JUNCTION WHARVES.

Beginning at a point A on the westerly side of Meridian-street Bridge and about sixty-three feet southerly from the draw, and marked by a copper tack and an iron plate, in lat. $42^{\circ} 23' 06''.233$, long. $71^{\circ} 02' 02''.596$; thence straight south-westerly 817.9 feet to point B, in lat. $42^{\circ} 23' 01''.847$, long. $71^{\circ} 02' 11''.750$; thence straight more southerly 884.3 feet to point C near McKay's Wharf in lat. $42^{\circ} 22' 53''.663$, long. $71^{\circ} 02' 15''.875$; thence straight southerly and a little westerly 1,773.9 feet to point D, the north-westerly corner of Green's Wharf, in lat. $42^{\circ} 22' 36''.144$, long. $71^{\circ} 02' 16''.541$; thence straight southerly and a little more westerly 1,123.4 feet to point E nearly opposite Burnham's dry dock in lat. $42^{\circ} 22' 25''.210$, long. $71^{\circ} 02' 19''.109$; thence straight south-westerly 994.7 feet to point F, the north-westerly corner of Mayo's south wharf, in lat. $42^{\circ} 22' 16''.402$, long. $71^{\circ} 02' 24''.987$; thence southerly 474.6 feet on a curve of 512.3 feet radius tangent at F to the line EF and curving easterly to the point G in lat. $42^{\circ} 22' 11''.879$, long. $71^{\circ} 02' 24''.964$; thence straight south-easterly tangent at G to the curve FG 2,591.3 feet to the point H near the Eastern R.R. and Cunard Wharves in lat. $42^{\circ} 21' 49''.019$, long. $71^{\circ} 02' 09''.421$; thence more easterly along the front lines of the Cunard and Grand Junction Wharves 1,018.3 feet to the point I, the south-easterly corner of Pier 4, Grand Junction Wharves in lat. $42^{\circ} 21' 43''.888$, long. $71^{\circ} 01' 57''.753$.

Geographical Positions of Reference Points and Bearings and Distances connecting them with the Initial Points of the Harbor Lines of East Boston from Meridian-street Bridge to Pier Four of the Grand Junction Wharves.

Reference Points.	LOCATION.	Latitude.	Longitude.	Distance Meters.	Log. Meters.	Distance Feet.	Log. Feet.	Azimuth.	Back Azimuth.	Initial Points.
A	Meridian-street Bridge about 63 feet south of draw opening	Deg. Min. Sec. 42 23 06.283	Deg. Min. Sec. 71 02 02.596	—	—	—	—	Deg. Min. Sec. —	Deg. Min. Sec. —	—
C'	McKay's Wharf	42 22 53.615	71 02 14.935	21.55	1.3334851	70.7	1.8494528	93 56 25	273 56 24	C
D'	Green's Wharf	42 22 36.130	71 02 16.478	1.51	0.1777592	4.9	0.6937269	107 13 30	287 13 30	D
E'	Burnham's Dry Dock Wharf	42 22 23.855	71 02 17.477	56.05	1.7485678	183.9	2.2645355	138 14 01	318 14 00	E
E''	Burnham's Marine R'way Wharf,	42 22 23.494	71 02 19.738	54.86	1.7392810	180.0	2.2552487	195 12 18	15 12 18	E
F'	Mayo's South Wharf	42 22 16.350	71 02 24.964	1.69	0.2291071	5.6	0.7450748	161 26 23	341 26 23	F
G'	Whidden's Wharf	42 22 12.924	71 02 25.290	33.09	1.5197235	108.6	2.0356912	346 58 30	166 58 30	G
G''	Potter & Wrightington's Wharf,	42 22 10.830	71 02 23.843	41.29	1.6158803	135.5	2.1318480	141 36 22	321 36 22	G
H'	Eastern Railroad Wharf	42 21 49.928	71 02 09.814	29.45	1.4690992	96.6	1.9850669	342 13 22	162 13 22	H
H''	Cunard Wharf	42 21 48.552	71 02 08.287	29.68	1.4724333	97.4	1.9884010	119 02 40	299 02 38	H
I'	Pier 4, Grand Junction Wharves,	42 21 43.917	71 01 57.756	0.91	9.9590414	3.0	—	356 01 53	176 01 53	I

DRAWS IN THE BRIDGES ACROSS MERRIMACK RIVER
BELOW HAVERHILL.

By the resolve chap. 23 of the Acts of 1881 the Board was instructed to investigate the subject, and report their conclusions in regard to widening the draws in the bridges across the Merrimack River below Haverhill.

In ascending the river from its mouth, the first bridge across it is the road-bridge between Newburyport and Salisbury, and the second the railroad-bridge of the Eastern Railroad Company; these two bridges are so near together that the draw-ways are connected by a continuous draw-pier and the passage-way through each bridge is about seventy feet in width. The draws and abutment-piers are in good condition. The plan and alignment of the connecting draw-pier, however, are not as well arranged for the passage of vessels through the bridges as the general location will admit. Owing to unsettled questions of obligation on the part of the city of Newburyport and the Eastern Railroad Company, this draw-pier has never been completed.

The third bridge in order across the river is the chain bridge, so called, between Newburyport and Salisbury. This bridge consists of two parts,—one a chain suspension bridge between the Newburyport shore and Deer Island; and the other, between Deer Island and the Salisbury shore, is composed of a wooden girder with arched lower chord next to Deer Island, and beyond it a leaf-draw and two short spans crossed by simple trusses.

The chain bridge is well built and in good repair, and the channel under it is used by steamers and other mast-less craft in preference to the draw-way opening.

The piers in the other part of the bridge are poorly designed, poorly built, and out of repair, being unnecessarily wide with square ends presented to the current, which create strong eddies in both the flood and ebb tides which set strongly against the southerly side of the draw-way so that the passage through it is difficult. The piers consist of a foundation of crib-work up to about high-water mark; and resting upon these is light trestle-work up to the level of the bridge and extending a short distance on either side of the draw to serve as draw-piers, but is not high enough to be

of the best service, and is much out of repair, and slowly pressing into and narrowing the draw-way which has now a least available width of about 38 feet. The sheathing on the sides of the draw-way is also in bad condition and insufficient.

The abutments and superstructure of this part of the bridge are in good condition, and apparently require only ordinary repairs.

The fourth bridge is "Rocks Bridge," so called, between Haverhill and West Newbury. This bridge has four fixed spans and a draw-span, which are supported by two abutments and four piers. The piers are built of dimension granite resting on timber cribs filled with stone. The masonry of the piers is in generally good condition; but the timber of the cribs is considerably worn and broken, and in its present state liable to be damaged by ice, although it may stand some years without material injury, depending on the character of the winter and the manner in which the ice breaks up in the spring.

The superstructure of this bridge is somewhat out of repair in places; the trusses are bent or buckled, and not capable of sustaining as much weight as they should; but with moderate repairs and ordinary travel it may last for a number of years. The draw-span is a common leaf-draw, with a least width of 31.8 feet, in good repair, and is situated at the easterly end of the first span on the Haverhill side of the river, and on the westerly side of the channel. The flood-tide sets diagonally across the draw-way so that vessels are carried against the pier on the westerly side of the opening. Their passage through the draw-way might be facilitated, however, by draw-piers on either side of the bridge on the westerly side of the draw-way.

If the draw-way is widened, it should be located in the span next east of the present site, which would be nearer the centre of the river and current, and have an equal depth of water.

Groveland Bridge is the next in order, and is now in process of rebuilding. It is proposed to locate the draw-way in the middle of the channel, and to have it about sixty feet wide. When this bridge is complete it will be one of the best structures on the river. No other changes of plan are

necessary for further facility to navigation than already provided.

The draws in some of the bridges above referred to have been reported by parties, more particularly interested in steamboat-navigation, as not being of sufficient height above the level of the water to enable certain classes of steamboats to pass freely under them, which is considered a desirable facility of navigation, and it certainly is so where it can be practicably effected. But when a bridge is provided with a suitable draw which can be opened readily for the passage of all vessels which cannot pass under it, it seems like imposing a double burden to require a height of structure which would involve undue expense, or which would be out of proportion or adjustment, so to speak, with the approaches to and character of the respective shores of the river between which it crosses.

The relative burden upon the respective cities and towns in whose jurisdiction these bridges belong, of the expense of keeping them in repair and from time to time adapting them to improved and progressive modes of navigation, as compared with the importance and value to commerce and the public of the repairs and improvements requisite, is the problem to be solved in determining the improvements to be made. While the facilities afforded by these bridges of communication between the cities and towns bordering upon and near the river may have a beneficial public influence extending beyond their immediate locality, they have not the capacity nor the function of the waters of the river as a medium of communication and transportation which is almost limitless in its range and power. One instance of its value in this respect is the conveyance in one steamboat, in one summer season only, of thirty thousand persons from interior localities to the sea-beach for health and recreation.

The value of commercial transportation has also been recognized by the General Government in the liberal appropriations made and the laborious work done to improve the navigation of the river, the efficiency and even *possibility* of which is gauged by the capacity of the passage-ways through the bridges which cross its channels. These channels were a *first right of way*; and no restriction or interference with this right should be permitted or continued which is not of equivalent public value and advantage.

In view of the facts and circumstances which the Board have been able to ascertain in relation to the subject referred to them for investigation, they submit the following conclusions : —

First, The draw-way opening and draw in the part of the “Chain Bridge” between Deer Island and the Salisbury shore should be rebuilt and widened so as to give a clear passage-way of not less than fifty feet. In making the necessary alterations to effect this change, the lower members of the draw should be made as high above the water-level of the river as can be practicably accomplished without involving too radical a change in other features of the bridge. Suitable draw-piers should be built on either side of the bridge, and other modern appliances provided for the safe and convenient passage of vessels through the draw-way.

Second, The draw-way and draw in “Rocks Bridge” should be rebuilt at least fifty feet wide, and located in the span next east of the one in which it now is. The lower members of the draw should also be made as high as practicable above the water-level of the river. Suitable draw-piers and other appliances should be provided as for the other bridge.

Third, The draw pier between and connecting the city and railroad bridges at Newburyport should be completed, and such changes made in its alignment as will best secure the safe and convenient passage of vessels through these two bridges, which must be done by one operation while both of the draws are open.

VINEYARD HAVEN HARBOR.

At the request of citizens of Vineyard Haven, and after the conclusion by the Board of its expediency, a re-survey of portions of the harbor was made by the engineer during the last summer as a means of comparison with former observations, and to show what changes, if any, had taken place in the harbor. The results did not show the changes which local observers had anticipated in the general condition of the harbor. The anxiety manifested, however, by those continually observing it, is but the renewal of the subject of its value and the importance of some adequate means for the protection of the thousands of vessels which seek its anchorage grounds. This matter in the logic of events must sooner

or later receive the practical attention of the General Government. We need hardly reiterate the fact that the geographical position and peculiar surroundings of this harbor make it one of the most remarkable roadsteads, not only within the limits of this Commonwealth but in the whole range of the Atlantic coast of the United States. Its proximity to the pathway of the immense coastwise fleet which night and day continually pass its headlands, its accessibility in all winds and weather, and being at the threshold, as it were, of the dangerous region of fog and shoals which characterize the navigation around Cape Cod, make its value as a refuge almost beyond estimate. It is excellent in all the conditions of a roadstead save one, — that of exposure to the north-east. The correction of this defect, which is a practicable one, is the improvement and protection needed to make it one of the most useful harbors of the world.

BOUNDARY-LINES BETWEEN CITIES AND TOWNS BORDERING UPON THE SEA.

By chap. 196 of the Acts of 1881 the Board was directed to locate and define the courses of the boundary-lines between adjacent cities and towns bordering upon the sea, and upon arms of the sea, from high-water mark outward to the line of the Commonwealth as defined by sect. 1 of chap. 1 of the Revised Statutes; and to file a report of their doings, with suitable plans and exhibits, showing the boundary-lines of any town by them located and defined, in certain specified places.

So much of sect. 1 chap. 1 of the Revised Statutes, as refers to the extension of the boundary-lines between cities and towns bordering upon the sea, to the line of the Commonwealth, is as follows: "The territorial limits of this Commonwealth extend one marine league from its seashore at low-water mark. When an inlet or arm of the sea does not exceed two marine leagues in width, between headlands, a straight line from one headland to the other is equivalent to the shore-line."

It was quite impracticable for the Board to make original surveys, or prepare original plans upon which to show the lines to be located and defined, according to the act directing that work to be done; and no survey of limited scope

or means which they could make would have been so well adapted to the purposes required as the elaborate and accurate ones of the United States Coast and Geodetic Survey. The system upon which these maps are made affords the particular data desired in locating and describing the initial points in the line of State jurisdiction, which it is important to define in order to locate the points of intersection with it, or the termination at it of the boundary-lines between respective cities and towns. The details of coast topography upon these government maps also afford data for determining the points upon the shore where boundary-lines on land terminate. The maps selected are classed and entitled "Coast Charts Nos. 11, 12, and 13, coast of the United States," "Coast Charts Nos. 9 and 10, Massachusetts Bay," and "Coast Chart No. 8, from Wells to Cape Ann." The first three in one sheet include the line of the Commonwealth from the boundary with Rhode Island to Chatham on Cape Cod, the second two in one sheet the line of the Commonwealth from Chatham to the Dry Salvages on Cape Ann, and the third from the Dry Salvages to the boundary with New Hampshire.

The Board has found the duty imposed upon them one of peculiar interest; and, so far as they are aware, it is the first instance of such action being taken, and such illustrated determination of the limits of territorial jurisdiction being made, by any State bordering upon the sea. The work has proved to be more exacting than at first supposed, and will require more time and means to complete than was originally estimated. In examining the records, markings, and geographical peculiarities of the various terminal points of the boundary-lines between cities and towns upon the shore, it has been found necessary to visit the locality of nearly every terminal point so far considered, in order to ascertain the nature and particulars of each, whether on land and marked by monument, or whether in the mouth of some channel, bay, or creek. These have been conditions and facts necessary to determine, before the study of the extension of any given boundary-line to the line of the Commonwealth could be made and projected upon the plan. In some cases the Board has found difficulty in determining these bases for locating and defining the courses of respec-

tive boundary-lines. Two cases, those between Provincetown and Truro, and between Sandwich and Wareham, have presented questions of so much import as to require public hearings, and, in the case of Sandwich and Wareham, the action of learned counsel on either side. In this latter case the Board has held hearings at the location of the line, and in the office of the Board at Boston.

It has been found impracticable, within the past appropriate season, to do more than examine the series of boundary-lines between the towns in the peninsular portion of Cape Cod, from and including the boundary-line before mentioned, between Sandwich and Wareham, and Provincetown at the east and Gosnold at the west end of the Cape. The Board has projected, upon the maps referred to, the line of the Commonwealth. The position of the initial points, or points of deflection, in this line of the Commonwealth, are plotted to single seconds of latitude and longitude, which is as near as the scale of the maps will accurately exhibit. These positions can be reproduced upon any map of the Coast Survey, of any scale, and can be found upon the ground or water, by instrumental observation, by any competent engineer or surveyor. The limit of error or indefiniteness in the exact position of each point will not exceed a mean difference of about twenty-seven metres, equal to about twenty-nine yards. When it is considered that these points represent positions on the ocean, not less than three marine leagues from the nearest land, this location of a point is sufficiently represented for all practicable purposes. The maps on which the line is plotted are based upon a polyconic projection on a scale of $\frac{1}{800000}$, whereon each fifth minute of latitude and longitude is drawn.

LINE OF THE COMMONWEALTH.

The line of the Commonwealth begins at a point marked A on plan No. 3, which is comprised of the United States Coast and Geodetic Survey "Coast Charts Nos. 11, 12, and 13," in lat. $41^{\circ} 25' 05''$, long. $71^{\circ} 05' 28''$, distant one marine league from the shore-line, which is a line from the headland at Warren's Point in Rhode Island to the headland at Gooseberry Neck in Massachusetts, and runs easterly, parallel to the last-named line, to a point marked B on plan, in lat. $41^{\circ} 25' 25''$, long. $71^{\circ} 03' 16''$.

Thence south-easterly, parallel to and distant one marine league from a line from the said headland at Gooseberry Neck to the headland at the south-westerly point of the island of Cuttyhunk, to a point marked C on plan, in lat. $41^{\circ} 22' 23''$, long. $70^{\circ} 59' 33''$.

Thence south-easterly, on the arc of a circle of one marine league radius, from the said headland at Cuttyhunk to a point marked D on plan, in lat. $41^{\circ} 21' 55''$, long. $70^{\circ} 58' 50''$.

Thence south-easterly, parallel to and distant one marine league from a line from said headland at Cuttyhunk to the headland at the north-westerly point of Gay Head on the island of Martha's Vineyard, to a point marked E on plan, in lat. $41^{\circ} 19' 30''$, long. $70^{\circ} 53' 55''$.

Thence southerly, parallel to and distant one marine league from a line from the said headland at Gay Head to the headland at the westerly point of the island of No Man's Land, to a point marked F on plan, in lat. $41^{\circ} 15' 17''$, long. $70^{\circ} 53' 32''$.

Thence south-easterly, easterly, and north-easterly, on a curved line parallel to and distant one marine league from the general curve of the southerly shore-line of said No Man's Land, to a point marked G on plan, in lat. $41^{\circ} 13' 32''$, long. $70^{\circ} 44' 15''$.

Thence north-easterly, parallel to and distant one marine league from a line from the south-easterly headland of said No Man's Land to the south-easterly headland of Squipnocket on said Martha's Vineyard, to a point marked H on plan, in lat. $41^{\circ} 16' 18''$, long. $70^{\circ} 42' 26''$.

Thence north-easterly, parallel to and distant one marine league from a line from said headland at Squipnocket to the headland at the easterly end of Nashaquitsa Cliff on said Martha's Vineyard, to a point, marked I on plan, in lat. $41^{\circ} 17' 25''$, long. $70^{\circ} 40' 48''$.

Thence easterly, on a slightly curved line parallel to and distant one marine league from the general curve of the shore-line of said Martha's Vineyard, to a point marked K on plan, in lat. $41^{\circ} 17' 45''$, long. $70^{\circ} 35' 30''$.

Thence easterly, on a slightly curved line parallel to and distant one marine league from the general curve of the shore-line on said Martha's Vineyard, to a point marked L on plan, in lat. $41^{\circ} 17' 35''$, long. $70^{\circ} 26' 43''$.

Thence easterly, a little southerly, parallel to and distant one marine league from a line from the south-easterly headland of the island of Chappaquiddick to the headland at the south-easterly point of the island of Muskeget, to a point marked L^1 , in lat. $41^\circ 16' 34''$, long. $70^\circ 21' 30''$.

Thence south-easterly, on the arc of a circle of one marine league radius from the southerly Sand Island between the said island of Muskeget and the island of Tuckernuck, to a point marked M on plan, in lat. $41^\circ 15' 46''$, long. $70^\circ 20' 10''$.

Thence south-easterly, on a slightly curved line parallel to and distant one marine league from the general curve of the shore-line of the southerly shore of the island of Nantucket, to a point marked M^1 on plan, in lat. $41^\circ 11' 20''$, long. $70^\circ 06' 55''$.

Thence easterly, parallel to and distant one marine league from a line from the headland opposite Miacomet Pond to Tom Never's Head on said Nantucket, to a point marked M^2 on plan, in lat. $41^\circ 11' 06''$, long. $70^\circ 00' 30''$.

Thence easterly and some northerly, on a curved line parallel to and distant one marine league from the general curve of the shore-line of said Nantucket, to a point south-east of the south-easterly headland at Siasconsett, marked M^3 on plan, in lat. $41^\circ 12' 30''$, long. $69^\circ 55' 15''$.

Thence north-easterly and northerly, on a curved line parallel to and distant one marine league from the general curve of the shore-line of said Nantucket, to a point east of the light-house at Sankaty Head, marked M^4 on plan, in lat. $41^\circ 16' 55''$, long. $69^\circ 53' 15''$.

Thence north-westerly, on a slightly curved line parallel to and distant one marine league from the general curve of the shore-line of said Nantucket, to a point north-easterly from the northerly headland at Great Point, marked M^5 on plan, in lat. $41^\circ 25' 55''$, long. $69^\circ 59' 55''$.

Thence north-westerly, westerly, and south-westerly, on the arc of a circle of one marine league radius from said headland at Great Point, to a point marked M^6 on plan, in lat. $41^\circ 24' 26''$, long. $70^\circ 06' 27''$.

Thence southerly and some westerly, parallel to and distant one marine league from a line from said headland at Great Point to the headland at the south-westerly point of

Coatuc Beach, to a point marked M⁷ on plan, in lat. 41° 20' 39", long. 70° 07' 47".

Thence westerly, parallel to and distant one marine league from a line from said headland at Coatuc Beach to the headland opposite the north-easterly cove of Matacut Harbor, to a point marked M⁸ on plan, in lat. 41° 20' 38", long. 70° 10' 10".

Thence north-easterly, parallel to and distant one marine league from the line from said headland near Matacut Harbor to the headland at the easterly point of Muskeget Island, to a point marked M⁹ on plan, in lat. 41° 22' 44", long. 70° 15' 24".

Thence westerly and southerly, on a curved line parallel to and distant one marine league from the general curve of the shore-line of the northerly side of said Muskeget Island, to a point marked M¹⁰ on plan, in lat. 41° 23' 15", long. 70° 19' 15".

Thence north-westerly, parallel to and distant one marine league from a line from the headland at the north-westerly point of said Muskeget Island to the headland opposite the south-easterly cove of Cape Poge Bay on the said Chappaquiddick Island, to a point marked N on plan, in lat. 41° 24' 40", long. 70° 22' 32".

Thence northerly and north-westerly, partly on a curved line and partly on the arc of a circle distant one marine league and radius one marine league from the shore-line and headland at the north-easterly point of said Cape Poge, to a point marked O on plan, in lat. 41° 27' 53", long. 70° 24' 35".

Thence north-westerly, parallel to and distant one marine league from a line from said headland at Cape Poge to the headland at the northerly point of the East Chop of Vineyard Haven, on said Martha's Vineyard, to a point marked P on plan, in lat. 41° 29' 11", long. 70° 27' 38".

Thence north-easterly, parallel to and distant one marine league from a line from said headland at East Chop to the headland between Waquoit and Popponessett Bays on the main shore, to a point marked Q on plan, in lat. 41° 30' 53", long. 70° 25' 55".

Thence north-easterly, parallel to and distant one marine league from a line from said last-named headland to the

headland opposite the south-easterly cove of Oysterville Harbor, to a point marked R on plan, in lat. $41^{\circ} 33' 23''$, long. $70^{\circ} 21' 34''$.

Thence easterly, parallel to and distant one marine league from a line from the said headland at Oysterville to the headland at Point Gammon, to a point marked S on plan, in lat. $41^{\circ} 33' 18''$, long. $70^{\circ} 15' 35$.

Thence easterly, on the arc of a circle of one marine league radius from said headland at Point Gammon, to a point marked T on plan, in lat. $41^{\circ} 33' 31'$, long. $70^{\circ} 14' 11''$.

Thence north-easterly, parallel to and distant one marine league from a line from said headland at Point Gammon to the headland on the east side of Swan Pond River, to a point marked U on plan, in lat. $41^{\circ} 36' 01''$, long. $70^{\circ} 06' 55''$.

Thence north-easterly, parallel to and distant one marine league from a line from said headland near Swan Pond River to the headland near Red River, to a point marked V on plan, in lat. $41^{\circ} 36' 30''$, long. $70^{\circ} 03' 45''$.

Thence southerly, parallel to and distant one marine league from a line from the headland at Inward Point on Monomay Island to the headland at the southerly point of said Monomay Island, to a point marked W on plan, in lat. $41^{\circ} 33' 07''$, long. $70^{\circ} 04' 30''$.

Thence southerly, south-easterly, and easterly, on the arc of a circle of one marine league radius from said headland at Monomay to a point marked W on plan, in lat. $41^{\circ} 30' 12''$, long. $69^{\circ} 58' 05''$.

Thence north-easterly, on a curved line parallel to and one marine league distant from the general curve of the shoreline of Monomay Island, to a point marked X on plan, in lat. $41^{\circ} 32' 17''$, long. $69^{\circ} 55' 21''$.

Thence northerly, a little easterly, parallel to and distant one marine league from the line from the headland near Monomay Light-house to the headland opposite Rump Hole on said Monomay Island, to a point marked Y on plan, in lat. $41^{\circ} 36' 42''$, long. $69^{\circ} 52' 58''$.

Thence north, a little easterly, parallel to and distant one marine league from a line from the said headland near Rump Hole to the headland opposite Morris Island, to a point marked Y¹ on plan, in lat. $41^{\circ} 38' 06''$, long. $69^{\circ} 52' 20''$.

Thence northerly, a little easterly, parallel to and distant

one marine league from a line from the said headland near Morris Island to the headland near Allen's Point on Nausett Beach, to a point marked Z on plan, in lat. $41^{\circ} 42' 31''$, long. $69^{\circ} 51' 05''$.

Thence northerly, on a slightly curved line parallel to and distant one marine league from the general curve of the shore-line, to a point marked A² on plan, which is identical with the point marked A on plan No. 2 comprised of the United States Coast and Geodetic Survey "Coast Charts No. 9 and 10," in lat. $41^{\circ} 49' 02''$, long. $69^{\circ} 51' 55''$.

Thence north, a little easterly, on a slightly curved line parallel to and distant one marine league from the general curve of the shore-line, to a point marked B on said plan No. 2, in lat. $41^{\circ} 53' 40''$, long. $69^{\circ} 53' 12''$.

Thence north, a little westerly, on a curved line parallel to and distant one marine league from the general curve of the shore-line, to a point marked B¹ on plan, in lat. $41^{\circ} 59' 18''$, long. $69^{\circ} 55' 50''$.

Thence north, more westerly, on a curved line parallel to and distant one marine league from the general curve of the shore-line, to a point marked C on plan, in lat. $42^{\circ} 04' 33''$, long. $70^{\circ} 00' 20''$.

Thence north-westerly, on a curved line parallel to and distant one marine league from the general curve of the shore-line, to a point marked C¹ on plan, in lat. $42^{\circ} 07' 32''$, long. $70^{\circ} 08' 00''$.

Thence westerly, on a curved line parallel to and distant one marine league from the general curve of the shore-line, to a point marked D on plan, in lat. $42^{\circ} 07' 34''$, long. $70^{\circ} 14' 15''$.

Thence south-westerly and southerly, on a curved line parallel to and distant one marine league from the general curve of the shore-line, to a point marked D¹ on plan, in lat. $42^{\circ} 03' 42''$, long. $70^{\circ} 18' 22''$.

Thence south-easterly, partly on a curved and partly on a straight line parallel to and distant one marine league from the general curve and trend of the shore-line, to a point marked E on plan, in lat. $41^{\circ} 58' 57''$, long. $70^{\circ} 14' 01''$.

Thence south-easterly, parallel to and distant one marine league from a line from the headland at Wood End to the headland at Boundbrook Island, to a point marked F on plan, in lat. $41^{\circ} 55' 01''$, long. $70^{\circ} 08' 27''$.

Thence southerly, parallel to and distant one marine league from a line from the said headland at Boundbrook Island to the headland at the southerly end of Great Beach Hill, to a point marked G on plan, in lat. $41^{\circ} 53' 10''$, long. $70^{\circ} 08' 26''$.

Thence southerly, parallel to and distant one marine league from a line from said headland at Great Beach Hill to the headland at Billingsgate Island, to a point marked H on plan, in lat. $41^{\circ} 51' 40''$, long. $70^{\circ} 08' 08''$.

Thence southerly, parallel to and distant one marine league from a line from said headland at Billingsgate Island to the headland near the village of Brewster, to a point marked I on plan, in lat. $41^{\circ} 48' 38''$, long. $70^{\circ} 08' 39''$.

Thence westerly, a little southerly, parallel to and distant one marine league from a line from said headland near Brewster to the headland on Beach Point, to a point marked K on plan, in lat. $41^{\circ} 47' 18''$, long. $70^{\circ} 16' 38''$.

Thence westerly, parallel to and distant one marine league from a line from said headland at Beach Point to the headland near Scorton Neck, to a point marked L on plan, in lat. $41^{\circ} 47' 31''$, long. $70^{\circ} 22' 54''$.

Thence north-westerly, parallel to and distant one marine league from a line from the said headland near Scorton Neck, to the headland at Scusset Beach, to a point marked M on plan, in lat. $41^{\circ} 49' 26''$, long. $70^{\circ} 27' 03''$.

Thence northerly, parallel to and distant one marine league from a line from the said headland at Scusset Beach to the headland at Centre Hill Point, to a point marked N on plan, in lat. $41^{\circ} 51' 50''$, long. $70^{\circ} 27' 08''$.

Thence northerly, a little westerly, parallel to and distant one marine league from a line from the said headland at Centre Hill Point to the headland at Manomet Point, to a point marked O on plan, in lat. $41^{\circ} 56' 09''$, long. $70^{\circ} 27' 56''$.

Thence south-westerly, on the arc of a circle of one marine league radius from said headland at Manomet Point, to a point marked P on plan, in lat. $41^{\circ} 57' 10''$, long. $70^{\circ} 28' 23''$.

Thence north-westerly, parallel to and distant one marine league from a line from said headland at Manomet Point to the headland at Gurnet Point, to a point marked Q on plan, in lat. $42^{\circ} 01' 40''$, long. $70^{\circ} 31' 59''$.

Thence north-westerly, parallel to and distant one marine league from a line from the said headland at Gurnet Point

to the headland at Brant Rocks, to a point marked R on plan, in lat. $42^{\circ} 06' 34''$, long. $70^{\circ} 34' 23''$.

Thence north-easterly, on the arc of a circle of one marine league radius from said headland at Brant Rocks, to a point marked S on plan, in lat. $42^{\circ} 07' 17''$, long. $70^{\circ} 34' 53''$.

Thence north-westerly, parallel to and distant one marine league from a line from the said headland at Brant Rocks to the headland near North River, to a point marked T on plan, in lat. $42^{\circ} 10' 00''$, long. $70^{\circ} 37' 35''$.

Thence north-westerly, parallel to and distant one marine league from a line from the said headland near North River to the headland at Scituate Harbor, to a point marked U on plan, in lat. $42^{\circ} 13' 26''$, long. $70^{\circ} 38' 53''$.

Thence north-westerly, parallel to and distant one marine league from a line from the said headland at Scituate Harbor to the headland at Minot's Ledge, to a point marked V on plan, in lat. $42^{\circ} 17' 32''$, long. $70^{\circ} 41' 38''$.

Thence north-westerly, on the arc of a circle of one marine league radius from the said headland at Minot's Ledge, to a point marked W on plan, in lat. $42^{\circ} 18' 53''$, long. $70^{\circ} 43' 33''$.

Thence north, more westerly, parallel to and distant one marine league from a line from the said headland at Minot's Ledge to the headland at Point Allerton, to a point marked X on plan, in lat. $42^{\circ} 20' 20''$, long. $70^{\circ} 48' 00''$.

Thence north, a little easterly, parallel to and distant one marine league from a line from the said headland at Point Allerton to the headland at the North-east Graves, to a point marked Y on plan, in lat. $42^{\circ} 21' 46''$, long. $70^{\circ} 47' 38''$.

Thence north, a little easterly, parallel to and distant one marine league from a line from the said headland at North-east Graves to the headland at Great Pig Rocks, to a point marked Z on plan, in lat. $42^{\circ} 26' 20''$, long. $70^{\circ} 46' 58''$.

Thence north-easterly, parallel to and distant one marine league from a line from the said headland at Great Pig Rocks to the headland at Inner Breaker, to a point marked Z¹ on plan, in lat. $42^{\circ} 29' 00''$, long. $70^{\circ} 43' 22''$.

Thence north-easterly, parallel to and distant one marine league from a line from the said headland at Inner Breaker to the headland at Eastern Point, to a point marked Z² on plan, in lat. $42^{\circ} 32' 18''$, long. $70^{\circ} 36' 59''$.

Thence north-easterly, on a slightly curved line parallel

to and distant one marine league from the general curve of the southerly shore-line of Eastern Point, to a point marked Z^3 on plan, in lat. $42^\circ 32' 37''$, long. $70^\circ 36' 17''$.

Thence north-easterly, parallel to and distant one marine league from a line from the headland on the southerly shore of Eastern Point to the headland at Londoner, to a point marked Z^4 on plan, in lat. $42^\circ 35' 45''$, long. $70^\circ 31' 00''$.

Thence north-easterly and northerly, on the arc of a circle of one marine league radius from the said headland at Londoner, to a point marked Z^5 on plan, in lat. $42^\circ 38' 06''$, long. $70^\circ 29' 34''$.

Thence northerly, parallel to and distant one marine league from a line from the said headland at Londoner to the headland at Dry Salvages, to a point marked Z^6 on plan, in lat. $42^\circ 40' 26''$, long. $70^\circ 29' 40''$.

Thence northerly and north-westerly, on the arc of a circle of one marine league radius from said headland at Dry Salvages, to a point marked Z^7 on plan, which is identical with a point marked A on plan No. 1 comprised of the United States Coast Survey "Chart No. 8 from Wells to Cape Ann," in lat. $42^\circ 43' 04''$, long. $70^\circ 32' 09''$.

Thence north-westerly, parallel to and distant one marine league from a line from the said headland at Dry Salvages to the headland at Halibut Point, marked B on said plan No. 1, in lat. $42^\circ 44' 15''$, long. $70^\circ 35' 53''$.

Thence westerly, on the arc of a circle of one marine league radius from the said headland at Halibut Point, to a point marked C on plan, in lat. $42^\circ 44' 25''$, long. $70^\circ 38' 30''$.

Thence westerly, a little northerly, parallel to and distant one marine league from a line from a headland near the said Halibut Point to the headland at the southerly end of Plum Island, to a point marked D on plan, in lat. $42^\circ 45' 02''$, long. $70^\circ 42' 43''$.

Thence northerly, a little westerly, parallel to and distant one marine league from a line from the said headland at the southerly end of Plum Island to the headland near the mouth of Merrimack River, to a point marked E on plan, in lat. $42^\circ 48' 25''$, long. $70^\circ 43' 52''$.

Thence northerly, a little easterly, parallel to and distant one marine league from the said headland near the mouth of Merrimack River to the headland at Old Cellar Rock, to a

point marked F on plan, the northerly terminus of the line, in lat. $42^{\circ} 51' 55''$, long. $70^{\circ} 43' 26''$.

The linear extent of the line of the Commonwealth, in its course as above defined, around the islands of Martha's Vineyard and Nantucket, and around Cape Cod and Cape Ann from the point of boundary with the State of Rhode Island to the south-easterly point of Nantucket, is about 75 miles; to the southerly point of Monomay, about 158 miles; to the northerly point of Cape Cod at Race Point, about 222 miles; to the entrance of Boston Harbor, about 304 miles; to the easterly point of Cape Ann, about 336 miles; and to the northerly terminus of the line of the Commonwealth at its boundary with New Hampshire, about 355 miles.

The distance from the southerly terminus of the line of the Commonwealth at its boundary with Rhode Island to the southerly point of Monomay following the line of the Commonwealth and the line of boundary between the towns bordering on Vineyard Sound, is about 71 miles.

HARBOR IMPROVEMENTS BY THE GENERAL GOVERNMENT.

Boston Harbor.

The works of the General Government in the harbors of the State during the past year have been continued with increasing advantages to its commerce. The opportunities which the Board have had to observe the character and progress of this work make it gratifying as well as incumbent upon them to call attention to the long and interested service which the engineer officers of the United States in charge of it have rendered to the Commonwealth, and the value of their personal and professional experience in examinations and estimates, and in the execution of the varied and difficult projects of improvement submitted to their care. The Board is indebted to both Gen. Thom and Gen. Warren for the continued courtesy of information concerning their respective works.

In the northern division of the seacoast of the State, in charge of Gen. George Thom, United States engineer, the work done in Boston Harbor has been the important one of removing "Anchorage Shoal," in the main basin of the upper

harbor. 47,224 cubic yards have been dredged, which has added 225 feet to the width of the main channel, the aggregate of which is now about 770 feet. By the early part of March the width will be still further increased to about 810 feet, and by the end of next November the full projected width of the channel will be effected. The Board hope, however, that the development of the harbor has reached a point which will induce the General Government to revise its project for the improvement of the main channel so as to increase materially the minimum width heretofore contemplated.

In execution of the project for the improvement of Charles River, from its mouth to the dam at the head of tide-water at Watertown, 63,000 cubic yards of dredging has been done, and the improvement of the channel completed, from the mouth of the river to Western-avenue Bridge, a distance of about $4\frac{1}{2}$ miles.

At the mouth of the Mystic River 48,343 cubic yards of dredging has been done, which has increased the width of the channel by 125 feet, making its total average width 250 feet. Still further work of excavation has been begun, to be completed the coming season, which will complete the project of improvement for this river.

Repairs have been made, where most necessary, on the sea-walls of Lovell's Island, Long Island, and Deer Island.

21,924 cubic yards of dredging has been done in Nantasket Beach channel, which has opened the channel to a width of about 70 feet, and a depth at mean low water of $9\frac{1}{2}$ feet.

In order to complete all the works now projected for the improvement of Boston Harbor, the following appropriations have been asked for: to wit, —

Widening main ship channel at Upper Middle, at its westerly end, and for rebuilding and repairing sea-walls in Boston Harbor proper	\$24,000
Completing improvement of Charles River	67,500
Completing channel leading to Nantasket Beach	5,000
	<hr/>
	\$96,500

Merrimack River.

The improvement of the Merrimack River is a work of much importance, particularly to the citizens of the north-eastern portion of the State. The increased facilities given to all

classes of navigation by the aid of the General Government, and the improvement of the draw-way openings through the various bridges, will give a character and value to the river not heretofore possessed. As stated by Gen. Thom, the object of the present project for the improvement of this river is to afford a channel of navigable width and a depth of not less than nine feet at mean low water from its mouth at the outlet of Newburyport Harbor up to Deer Island Bridge, — a distance of about five miles; and thence up to Haverhill Bridge, — an additional distance of $12\frac{1}{2}$ miles, with a depth of twelve feet at ordinary *high water*, the rise and fall of tides varying from seven and a half to four feet; and thence up to the head of the “Upper Falls,” — a distance of four miles, a depth of not less than four feet and a half in the ordinary stages of the river, with the mill-water at Lawrence running, the rise and fall of the tides varying from four feet at Haverhill to none at the foot of the “Upper Falls.”

The natural channel of this river was very narrow and crooked in several places, and much obstructed by sunken ledges, bowlders, and shoals, and especially at the falls, portions of which were covered with bowlders and ledges more or less bare, and impassable for any vessels or scows; whilst in Newburyport Harbor the channel was obstructed by numerous sunken ledges, crib-work piers, and wrecks, seriously endangering navigation. Previous to January, 1881, the work done for the improvement of this river consisted in opening the channel above Haverhill and through the falls to the projected width and depth in places where absolutely necessary to make its navigation practicable, also in dredging at Haverhill between the bridges, and at Silsby Island shoals, as well as at Currier's shoal, about four miles below Haverhill, including the removal of a large number of dangerous sunken rocks at and near Rocks Bridge and the head of Silsby Island; also in Newburyport Harbor in the removal of “Ganway Rock” and “North Rocks” in part, and in the removal of two sunken wrecks. During the past year the removal of “South Ganway Rock” in Newburyport Harbor to a depth of nine feet at mean low water has been completed, together with the breaking up and removal of North Rock spur to a depth of nine feet, and the breaking up and removal of South Badger ledge near the mouth of the river to ten feet at mean low water.

Newburyport Harbor.

The project of improvement for Newburyport Harbor was to afford a permanent channel through the outer bar, with a depth sufficient to allow vessels of $13\frac{1}{2}$ feet draught to cross it at mean low water, the rise and fall of the tides being $7\frac{1}{2}$ feet. To effect this, the project of two converging rubble-stone jetties has been adopted, to be built out from the shore at points north and south of the entrance to a height of four feet above mean high water, with a width of 15 feet on top, with inner slope of 45° , and outer slope of $22\frac{1}{2}^\circ$, the entrance through the outer extremities of the jetties to be 1,000 feet in width. The cost of these jetties is estimated at \$365,000. Work has already been done on the northern jetty by the placing of about 13,743 tons of stone, whereby the work has been built out for a distance of about 700 feet from Salisbury Beach.

Scituate Harbor.

A survey of Scituate Harbor was made by Gen. Thom in 1878, with a view to its adaptability as a harbor of refuge, and a project devised for two rubble-stone jetties to protect the entrance; also to excavate a basin inside of sufficient area for the harbor, with a depth of ten to twelve feet at mean low water, the greatest depth at present being not more than about five feet on a very small area; also to excavate a channel into the harbor, with a depth of not less than ten feet at mean low water. The estimated cost of this improvement as revised for the project adopted is \$280,000. \$17,500 of this amount has been appropriated, and during the last summer, after many interruptions caused by unfavorable weather, 5,088 tons of stone have been put in place.

Plymouth Harbor.

The existence of this harbor depends upon the protection and preservation of Long Beach, which has been under the care of the government engineers from 1864 to and including 1881, and \$84,800 in various sums have been appropriated for their work. In 1875 a channel was dredged fifty feet wide and six feet deep at mean low water, from the "middle ground" up to "Long Wharf," — a distance of about 2,500 feet. The project of improvement, however, provides for a

channel 100 feet wide up to Long Wharf, and extended southward towards the mouth of Town Brook,—a distance of about 900 feet above Long Wharf,—so as to form a basin in front of the wharves of the city 150 feet in width and eight feet deep at mean low water. On the 1st of September, 1881, this project was entirely completed by the removal of 103,505 cubic yards of material from the channel and basin referred to. It is most gratifying to state that the only work that now remains to be done for the preservation and protection of this harbor consists in the repairs of the works on Long Beach where necessary.

Provincetown Harbor.

All the works projected for the protection, preservation, and improvement of this harbor have been completed, with the exception of the bulkheads on Long Point, which are in good condition, and fully answer the purposes designed. They will, however, require continual watching and occasional repairs.

Lynn Harbor.

A survey of Lynn Harbor has been made, with a view to its improvement, and a project and estimate for the respective work has been submitted to the Chief of Engineers to be laid before Congress.

Merrimack River, from Lawrence, Mass., to Manchester, N.H.

A survey, project, and estimate of cost for this part of the river—a distance of about forty-eight miles and a half—have been made, and submitted to the Chief of Engineers, to be laid before Congress.

GOVERNMENT WORK IN CHARGE OF GEN. G. K. WARREN.

The works of harbor improvement upon the southern coast of the State in charge of Gen. G. K. Warren, United States Engineers, are of much importance, particularly those of protection and improvement of the harbors of refuge in the dangerous navigation of this part of the coast.

Nantucket Harbor.

Up to the 30th of June last, nearly 4,000 tons of granite had been placed in the jetty on the westerly side of the

entrance to Nantucket Harbor, extending it 850 feet, and additional work has been done upon it since. Gen. Warren considers it too soon to see or predict the effect of the jetty in increasing the depth of water over the shoals; but careful and comprehensive surveys have been made as a basis for future comparison of changes following the construction of the jetty. Seventy-five thousand dollars is asked for the completion of this work by June 30, 1883.

Edgartown Harbor.

During the last summer a conference was held at Edgartown between Gen. G. K. Warren, the chairman of this Board, and the citizens of the port interested in the harbor, to discuss and devise means for its improvement.

With a small unexpended portion of a former government appropriation, to which the Board added the sum of \$300, a re-survey was made under the direction of Gen. Warren in order to ascertain and compare the changes which have taken place in various parts of the harbor since the closing of the south beach in 1869. Gen. Warren has taken renewed interest in the problem of re-establishing a southern inlet to this harbor; and, while there are many difficulties and uncertainties attending its accomplishment, he considers the possibilities of success sufficient to warrant another appropriation by the General Government for the required work.

Woods Holl.

The work of improvement in this important thoroughfare executed during the fiscal year ending June 30, 1881, consisted in removing bowlders of various sizes, and completing the work which had been in progress during the previous year. The original plan and estimate for the thorough improvement of this passage-way comprehended extensive excavations at a cost of \$430,000. The demand for this, however, does not seem to be immediate. Gen. Warren says, "This complete improvement may truly be called a national one. It is not for the benefit of any special locality. It is for a navigable highway uniting two large bodies of navigable water extensively used by the commercial vessels of the United States; and when thoroughly improved it will

tend greatly to a saving of time, and diminish the dangers of general coast navigation."

Taunton River.

Work has been executed for the improvement of Taunton River in conformity with previous plans and estimates, and a channel excavated eleven feet deep at mean high water, and from forty to sixty feet wide for a distance of 3,100 feet from the bridge at Weir down the river. An additional appropriation of \$25,000 has been made for continuing this improvement, and the amount estimated as necessary to complete the existing project to give an available depth of eleven feet at mean high water to Weir Bridge, is \$41,500.

Connecticut River.

The importance of the improvement of this river may be judged by the fact that after careful examination by the United States engineers, the amount estimated to complete existing projects is \$1,322,805. Satisfactory work has been done during the last year, and its continuance contemplated.

OFFICE AND FIELD WORK.

Plans approved and Licenses granted, during the Year 1881, for the Erection of Structures in and over Tide-Water.

Nos.

587. C. E. Stevenson, for leave to build a solid wharf on the south shore of Winthrop. Approved Jan. 13, 1881.
- 587½. Boston and Maine Railroad, for leave to rebuild its bridge across Merrimack River, between Bradford and Haverhill. Approved Jan. 20, 1881.
588. Killey E. Terry, for leave to construct a wharf on the west side of Clark's Cove, in the town of Dartmouth. Approved Jan. 20, 1881.
589. Old Colony Railroad Company, for leave to fill solid certain portions of its bridge on the line of its road across North River, in the towns of Marshfield and Scituate. Approved Jan. 20, 1881.
590. Hoosac Tunnel Dock and Elevator Company, for leave to extend its wharves (otherwise known as Damon's, Hittinger's, and Tudor's Wharves) on Charles River, Charlestown District. Approved Jan. 20, 1881.
591. Samuel Osborn, jun., and Walter S. Osborn, for leave to extend Osborn's Wharf, at Edgartown. Approved Feb. 3, 1881.
592. Boston and Albany Railroad Company, for leave to widen Pier No. 1, Grand Junction Wharves, East Boston. Approved Feb. 17, 1881.
593. P. E. Bowers, for leave to extend his wharf on Taunton River, in the town of Somerset. Approved Feb. 17, 1881.
594. The Boston Steamboat and Pier Company, for leave to construct a pile-pier on Cherry Island Bar, at Broad Sound Point, in the town of Revere. Approved March 17, 1881.
595. Moses Williams, for leave to straighten and widen the southerly side of India Wharf. Approved March 17, 1881.
596. City of Newburyport, for leave to construct a pile-structure for the purpose of giving greater safety to the first span in Newburyport Bridge. Approved March 25, 1881.
597. W. F. Whitney, for leave to extend his wharf on First Street, near F Street, South Boston. Approved March 31, 1881.
598. Hull and Nantasket Beach Railroad Company, for leave to construct a pile-wharf on the southerly side of Windmill Point, Hull. Approved March 31, 1881.
599. Forest Hill Company, for leave to build wharves and other structures on Taunton River, Fall River. Approved March 31, 1881.
600. Lyman R. Blake, for leave to construct a wharf on Charles Neck, town of Marion. Approved March 31, 1881.
601. J. H. and F. A. Langmaid, for leave to cover with a pile-structure part of their dock, Salem Harbor. Approved April 8, 1881.
602. O. F. Belcher, for leave to build a solid wharf on the south shore of Winthrop. Approved April 14, 1881.

44 HARBOR AND LAND COMMISSIONERS. [Jan.

Nos.

603. Chelsea Beach Railroad Company, for leave to build a bridge across an inlet from Pines River, in the town of Revere. Approved April 20, 1881.
604. Forest Hill Company, for leave to build a pile-wharf in front of its premises on the easterly side of Taunton River, city of Fall River. Approved April 21, 1881.
605. Eastern Railroad Company, for leave to fill flats in Frye's Mill-pond, Salem. Approved April 28, 1881.
606. City of Salem, for leave to build a canal with stone walls, in Frye's Mill-pond. Approved April 28, 1881.
607. Hoosac Tunnel Dock and Elevator Company, for leave to drive additional piles for the support of sheds upon Hittinger's Wharf, Charlestown District. Approved April 28, 1881.
608. William Pickering, jun., for leave to build a stone wall upon his wharf on Union Street, Salem. Approved April 28, 1881.
609. City of Boston, for leave to rebuild and extend its wharf on Deer Island, Boston Harbor. Approved May 5, 1881.
- 609^a. Central Wharf and Wet Dock Corporation, for leave to extend Central and India Wharves to the harbor line. Approved April 28, 1881.
610. Lyon, Depuy, and Co., for leave to rebuild and extend their wharf at East Boston. Approved May 19, 1881.
611. Hoosac Tunnel Dock and Elevator Company, for leave to extend its wharf, known as Gage's or Swett's Wharf, Charlestown District. Approved May 5, 1881.
612. Chelsea Beach Company, for leave to build a wharf at Pines Point, town of Revere. Approved May 26, 1881.
613. W. J. Humphrey, for leave to extend his wharf on Border Street, East Boston. Approved May 26, 1881.
614. Old Colony Railroad Company, for leave to extend its pile-wharf on Fort Point Channel, South Boston. Approved June 2, 1881.
615. Home for Aged Women, for leave to rebuild its sea-wall in front of its property bordering on Charles River, between Revere and Pinckney Streets. Approved June 16, 1881.
616. Eastern Railroad Company, for leave to widen and extend its wharf at East Boston. Approved June 3, 1881.
617. Edward P. Shaw, for leave to build a pile-pier on Merrimack River, near Salisbury Point. Approved June 13, 1881.
- 618 and 618^a. Chelsea Beach Railroad Company, for leave to construct a bridge across Pines River, in the towns of Revere and Saugus. Approved July 2, 1881.
619. Boston Forge Company, for leave to extend its wharf on Maverick Street, East Boston. Approved July 7, 1881.
620. Chelsea Beach Company, for leave to erect a group of bathing-houses near Pines Point. Approved July 14, 1881.
621. S. S. Swift of Provincetown, for leave to construct a pile-wharf in Provincetown Harbor. Approved July 21, 1881.
622. William Hayes, for leave to build a sea-wall and fill flats at Stage Point, Salem Harbor. Approved July 21, 1881.

Nos.

623. Boston Steamboat and Pier Company, for leave to extend its pier on Cherry Island Bar, at Broad Sound Point, in the town of Revere. Approved July 28, 1881.
624. Beacon Oil Company, for leave to extend its wharf on Chelsea Creek, East Boston. Approved July 28, 1881.
625. William Hale, for leave to extend his wharf on Merrimack River, City of Haverhill. Approved Aug. 4, 1881.
626. Hoosac Tunnel Dock and Elevator Company, for leave to drive additional piles upon Damon's Wharf, Charlestown District, for the support of sheds. Approved Aug. 11, 1881.
627. Alford Butler, for leave to build a wharf on Mill Creek, town of Revere. Approved Aug. 11, 1881.
628. William E. Gutterson, for leave to extend his wharf on Fort Point Channel. Approved Aug. 11, 1881.
629. Hoosac Tunnel Dock and Elevator Company, for leave to drive additional piles upon easterly Tudor Wharf, for the support of sheds, Charlestown District. Approved Sept. 22, 1881.
630. David L. and John G. Webster, for leave to build a wharf on Malden River, Malden. Approved Sept. 22, 1881.
631. R. W. Bowles, for leave to construct a wharf in Mattapoisett Harbor. Approved Sept. 22, 1881.
632. Board of Health of the town of Hull, for leave to construct a sewer outlet at Windmill Point, town of Hull. Approved Sept. 22, 1881.
633. Town of Malden, for leave to change the direction of Malden River, and also to construct a bridge across said river. Approved Sept. 29, 1881.
634. Boston and Maine Railroad, for leave to reconstruct its bridge across Merrimack River, between Bradford and Haverhill. Approved Sept. 29, 1881.
635. City of Boston, for leave to widen the passage-ways for vessels through Mount Washington Avenue Bridge, in Fort Point Channel. Approved Oct. 6, 1881.
- 635*. Trustees under the will of William S. Perry, for leave to extend Perry's Wharf, on Fort Point Channel, near Broadway Bridge. Approved Sept. 29, 1881.
636. Old Colony Railroad Company, for leave to extend its steamboat wharf, in the city of Fall River. Approved Oct. 13, 1881.
637. Nantasket Company, for leave to reconstruct its embankments along the line of high-water mark, on the inside or westerly shore of Nantasket Long Beach. Approved Oct. 15, 1881.
638. Proprietors of Rowe's Wharf, for leave to widen and extend their wharf to the harbor line, in Fort Point Channel. Approved Oct. 13, 1881.
639. Boston and Roxbury Mill Corporation, for leave to fill flats in Charles River, near the Beacon entrance of the Back Bay Park. Approved Nov. 10, 1881.
640. Thomas H. Balch, for leave to construct a pile-pier on Merrimack River, in the town of Groveland. Approved Oct. 27, 1881.

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641. Charles B. Barnes, for leave to extend his wharf, known as Humphrey's Wharf, Hingham Harbor. Approved Nov. 10, 1881.
642. N. P. Merriam, for leave to construct a pile-wharf near the foot of River Street, on Porter's River, Danversport. Approved Nov. 10, 1881.
643. John C. Tilton, for leave to extend his wharf on Merrimack Street, in the city of Haverhill. Approved Nov. 10, 1881.
644. Trustees under the will of Ebenezer Francis, for leave to extend Francis Wharf, on Fort Point Channel. Approved Nov. 28, 1881.
645. John S. Weeks, for leave to change a portion of his wharf from pile to solid, on Border Street, East Boston. Approved Dec. 1, 1881.
646. N. E. Harlow, for leave to extend his wharf in Plymouth Harbor. Approved Dec. 3, 1881.
647. Jabez K. Montgomery and Atwood L. Howard, lessees of the United States Government Wharf at Chelsea, for leave to drive piles in front of said wharf, in Chelsea Creek. Approved Dec. 8, 1881.
648. Samuel Haskell, for leave to extend his wharf in Gloucester Harbor. Approved Dec. 29, 1881.
649. Benj. F. Allen and Daniel Allen, jun., for leave to extend their wharf on Five Pound Island, Gloucester Harbor. Approved Dec. 29, 1881.
650. Charles Smiley, for leave to extend his wharf on Merrimack River, city of Haverhill. Approved Dec. 29, 1881.

Sixty-seven licenses have been granted, which is above the yearly average, though not as many as were issued in 1880. About one-third of the licenses granted were for structures in Boston Harbor. The Board has endeavored to make the inspection of localities where the erection of structures has been proposed, more thorough and systematic, and has found the demands upon its time and that of its employés to increase.

ALBERT MASON.
FRANCIS A. NYE.
HENRY L. WHITING.

BOSTON, Jan. 1, 1882.

APPENDIX.



APPENDIX.

[1.]

Articles of Agreement made this Twenty-first Day of June, in the Year Eighteen Hundred and Eighty-one, by and between F. G. WHITCOMB of East Boston in the County of Suffolk and Commonwealth of Massachusetts, Party of the First Part, and the COMMONWEALTH OF MASSACHUSETTS, acting by its Board of Harbor and Land Commissioners, Party of the Second Part, witness:—

The said party of the first part hereby covenants and agrees with said party of the second part to furnish all the materials, and build fourteen hundred (1,400) feet of bulkhead in three lines, as follows: one thousand (1,000) feet to be one hundred (100) feet east of and parallel to the easterly line of D Street, two hundred (200) feet to be two hundred and fifty (250) feet east of and parallel to the easterly line of C Street, and two hundred (200) feet to be one hundred (100) feet west of and parallel to the westerly line of C Street; each line to commence about two hundred and twenty (220) feet north-easterly of First Street, and run north-easterly.

The bulkhead is to be built of spruce piles driven six feet apart on centres, with a spurshore to each pile; and the piles are to be planked from the surface of the mud to grade seven (7).

The plan on file at the office of the Harbor and Land Commissioners shows the details and method of construction of the bulkhead, and is to be followed in details not otherwise mentioned.

The piles and spurshores shall be straight, and free from large knots, and not less than ten (10) inches diameter at the butt, and not less than six (6) inches diameter at the point when ready for driving. They are to be driven six (6) feet into the hard bottom, and all those injured by driving shall be removed and replaced by sound ones at the expense of the contractor.

The faces of the main piles must be brought to a true line before the planking is put on, the tops are to be cut off level at grade fourteen (14), and the spurshores are to be fitted at grade six and five-tenths (6.5); and each one will be bolted with one one-and-one-fourth-inch screw-bolt. The piles at the outer ends will be braced by two additional spurshores

fitted at grade ten (10), and bolted with one-and-one-fourth-inch screw-bolts.

The planks are to be spruce, three (3) inches thick, sound, sawed square, and not less than twelve (12) feet long. They are to be secured to the piles by wrought-iron ship-spikes six inches long, and three-eighths inch square, and the butt-joints must come on the piles.

If required by the engineer, the planks must be still farther secured, as shown in red on the afore-mentioned plan.

All the work to be done in a neat and workmanlike manner, in accordance with the lines, grades, and instructions given by the engineer, and to the satisfaction of the commissioners and the engineer

The work to be commenced within two weeks, and to be prosecuted continuously till its completion.

The said party of the second part hereby covenants and agrees with said party of the first part to pay said party of the first part for said bulkhead at the rate of one dollar and fifty-two cents (\$1.52) per lineal foot, and, in case said extra fastening is required, at the rate of one dollar and sixty-nine cents (\$1.69) per lineal foot for the part where said extra fastening is required.

Monthly estimates of the work done will be made by the engineer, and payment of ninety per cent of the contract-price will be made thereon, the remaining ten per cent to be retained until the completion, final measurement, and acceptance of the work.

It is agreed by and between the parties hereto that upon all questions of measurement, lines, or grades, the decision of the engineer of said board shall be final.

In testimony whereof the said F. G. Whitcomb has hereunto set his hand and seal, and the said Commonwealth has caused its seal to be hereto affixed, and these presents to be signed and delivered in its name and behalf by its Board of Harbor and Land Commissioners the day and year above written, and the same to be approved by its Governor and Council.

F. G. WHITCOMB.

[SEAL]

COMMONWEALTH OF MASSACHUSETTS,

[SEAL OF THE
COMMONWEALTH.]

By ALBERT MASON,
WILL'D P. PHILLIPS,
F. A. NYE.

IN COUNCIL, June 25, 1881.

Approved.

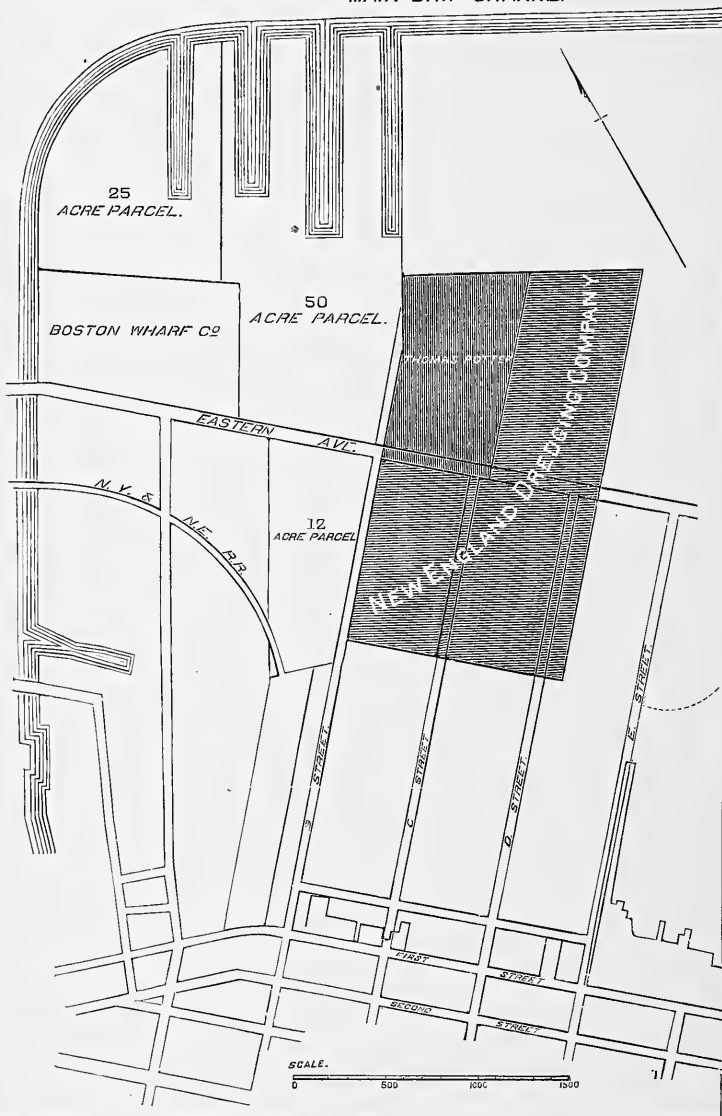
HENRY B. PEIRCE,
Secretary.



PLAN
SHOWING LOCATION OF FLATS.
TO BE FILLED UNDER CONTRACTS
TO ACCOMPANY REPORT FOR
1881.

MAIN SHIP CHANNEL.

FORT POINT CHANNEL.



[2.]

Articles of Agreement made this Twelfth Day of August, in the Year Eighteen Hundred and Eighty-one, by and between the NEW ENGLAND DREDGING COMPANY, a Corporation duly established under the Laws of Massachusetts, Party of the First Part, and the COMMONWEALTH OF MASSACHUSETTS acting by its Board of Harbor and Land Commissioners, Party of the Second Part, witness: —

The said party of the first part hereby covenants and agrees with said party of the second part :

First, to dredge five hundred thousand cubic yards of material from the shoals in the harbor of Boston, lying southerly of the main ship channel and north-westerly of slate ledge, at places to be designated by the engineer of the Board of Harbor and Land Commissioners, and to deposit said dredged material on the flats of said Commonwealth lying between B Street and a line one hundred feet east of and parallel with the easterly line of D Street, and between the southerly line of Eastern Avenue and a line about one thousand feet south of and parallel with the southerly line of Eastern Avenue.

Second, to dredge four hundred thousand cubic yards of material from the shoals in the harbor of Boston lying southerly of the main ship channel and north-westerly of slate ledge, and deposit the same on the flats of the Commonwealth lying between a line fifty feet east of and parallel with the easterly line of C Street extended, and a line one hundred feet east of and parallel with the easterly line of D Street extended, and between the southerly line of Eastern Avenue and a line one thousand three hundred feet south of and parallel with the exterior line of South Boston Flats, as shown on the plan hereto annexed. All the dredging shall be to the depth of twenty-three feet at mean low water, except at the mouth of Fort Point Channel, where the bottom shall be sloped up to meet the bottom, as now dredged, and excepting in case of ledge and of bowlders of more than one-half of one cubic yard. All areas dredged over shall be left smooth and regular at the required depths. If any portion of said dredged area is excavated deeper than twenty-five feet at mean low water, an amount of material equal to the amount excavated below grade minus 25 shall, without expense to the Commonwealth, be excavated from and deposited by scows on such places on the flats as the engineer shall designate. The amount of the excavation will be determined by the measurement of the filling as hereinafter provided.

All the flats to be filled shall be filled from the present surface to grade 13, and at the completion of the work shall be left smooth and level at grade 13, where the boundaries of said filling are protected by other filling or by bulkheads. The filling shall be brought up to grade 13 at

such boundaries, but where the boundaries are unprotected the filling is to be allowed to take its natural slope.

In filling immediately behind a bulkhead, the filling must be deposited in such a manner that it will flow away from the bulkhead and not towards it.

In the work of both dredging and filling, the lines, grades, and instructions given by the engineer in charge must be strictly observed, and all necessary aid and material for giving said lines and grades shall be furnished by said party of the first part.

All the work shall be done to the reasonable satisfaction of the engineer at any time during the progress, and until the completion and acceptance, of the work.

The dredging and filling of the area first described shall be completed, and 175,000 cubic yards of the filling of the second described area shall be completed, within three years from the date of approval of this contract, and the whole 900,000 cubic yards shall be completed within four years from date of approval.

The work shall be commenced within a reasonable time, and prosecuted with the necessary vigor to insure its completion within the time herein stipulated.

The said party of the second part hereby covenants and agrees with said party of the first part to pay said party of the first part for excavating in the harbor, and filling the area described first, at the rate of fifty cents per cubic yard; and for excavating in the harbor, and filling the area described second, at the rate of forty-six cents per cubic yard; in the manner and upon the conditions herein set forth and agreed as follows: plans showing the present surface of the flats will be made by the engineer in charge before the filling is begun, and will be used as the basis of all measurements of filling. Monthly estimates of the work executed will be made by the engineer in charge, and payment will be made of seventy-five per cent of the contract price for all the material deposited below grade 5 and above grade 13, and ninety per cent of the contract price for all the material between grades 5 and 13.

When an area is graded level at grade 13, or at such grade as shall be thought necessary to allow for settling, payment will be made of ninety per cent of the contract price for all the material deposited on said area up to grade 13. The remaining ten per cent to be retained until the final completion and acceptance of the work.

When the area filled from one tramway has been levelled and maintained at grade 13 for one month, such area shall be accepted as to grade, and the contractor relieved of further care of the same.

It is agreed by and between the parties hereto, that upon all questions of measurement, lines or grades proposed in writing by one party and after notice to the other party, the decision of the engineer of said Board shall be final.

It is further agreed by and between the parties hereto, that should the party of the first part refuse or neglect to prosecute the work herein contracted for, with the requisite vigor to insure its completion within the time herein stipulated, or in any other respect make any substantial

violation of this agreement, the said Board shall have power to annul this agreement and to contract anew with other parties without prejudice to the claim of said party of the second part for damages arising from breach hereof.

The party of the second part further covenants and agrees with the party of the first part to build a bulkhead on the northerly and easterly boundaries of said areas to be filled, and also on the line between said areas and the area to be filled by Thomas Potter under his contract with the said Commonwealth dated Aug. 28, 1880.

In testimony whereof the said New England Dredging Company has caused its corporate seal to be hereto affixed, and these presents to be signed and delivered in its name and behalf by Charles H. Souther, its president and treasurer; and the said Commonwealth has caused its seal to be hereto affixed, and these presents to be signed and delivered in its name and behalf by its Board of Harbor and Land Commissioners, the day and year above written, and the same to be approved by its Governor and Council.

NEW ENGLAND DREDGING COMPANY,

[NEW ENGLAND DREDG-
ING COMPANY SEAL,
1873.]

BY CHARLES H. SOUTHER,
Prest. & Treas.

Executed in presence of
D. KOPPMANN.

COMMONWEALTH OF MASSACHUSETTS,

[SEAL OF THE COMMON-
WEALTH OF MASSA-
CHUSETTS.]

BY ALBERT MASON,
FRANCIS A. NYE,
HENRY L. WHITING,
Harbor and Land Commissioners.

IN COUNCIL, Aug. 18, 1881.

Approved

HENRY B PEIRCE,
Secretary.

[3.]

Articles of Agreement made this Sixth Day of September, in the Year Eighteen Hundred and Eighty-One, by and between F. G. WHITCOMB of East Boston, in the County of Suffolk and Commonwealth of Massachusetts, Party of the First Part, and the COMMONWEALTH OF MASSACHUSETTS, acting by its Board of Harbor and Land Commissioners, Party of the Second Part, witness:—

The said party of the first part hereby covenants and agrees with said party of the second part, to furnish all the materials for and build about 4,000 feet of bulkhead on South Boston Flats, situated as follows: Beginning at the easterly line of B Street and southerly line of Eastern Avenue, running thence easterly along the southerly line of Eastern Avenue 600 feet, thence turning at right angles and running northerly 1,150 feet, thence turning and running easterly parallel to the exterior line of occupation of South Boston Flats, to a point 100 feet east of the easterly line of D Street extended, thence turning and running southerly parallel to and 100 feet east of the easterly line of D Street, about 2,280 feet, leaving a gap about 400 feet long in the most northerly line, and, if required, a gap in the most easterly line.

The bulkhead is to be built of spruce piles driven six feet apart on centres with two spurshores to each pile, and the piles planked from the surface of the mud to grade 13, and capped above the planks with a double girder cap each 6" \times 12".

The plans in the office of the Harbor and Land Commissioners show the details and method of construction of the bulkhead, and are to be followed in all details not mentioned in this contract.

The piles and spurshores shall be straight and free from large knots, and not less than ten inches in diameter at the butt, and not less than six inches in diameter at the point when ready for driving. They are to be driven ten feet into the hard bottom, and all those injured by driving shall be removed and replaced by sound ones at the expense of the contractor.

The faces of the main piles must be brought to a true line before the planking is put on, the tops are to be cut off and capped at grade 14, and the spurshores are to be fitted one at grade 4, and the other at grade 12, and each one will be bolted with one 1 $\frac{1}{4}$ inch screw-bolt. The end and corner piles are to be braced by four spurshores, instead of two, placed and fitted as directed by the engineer.

The caps are to be spruce, 6" \times 12", and as long as possible, none being less than fifteen feet, and shall be fitted as shown on the plan bolted to the piles with one-inch screw-bolts, and the splices bolted with $\frac{3}{4}$ inch screw-bolts.

The planks are to be spruce, three inches thick, and in as long lengths as possible, none being less than twelve feet long, and the butt-joints must come on the piles. They are to be spiked to the piles with $\frac{3}{8}$ inch square wrought-iron ship-spikes six inches long.

On the northerly and easterly lines the planking shall be still further secured by strips of spruce plank three inches by six inches well driven into the mud, and reaching to the top of the planking, and bolted through to the main piles by three $\frac{3}{4}$ inch screw-bolts.

All the timber to be sound, sawed square, and free from large knots.

All the work to be done in a neat and workmanlike manner, in accordance with the lines graded and instructions given by the engineer, and to the satisfaction of the commissioners and the engineer.

The work is to be commenced within a reasonable time, and prosecuted continuously in all suitable weather, till its completion.

The said party of the second part hereby covenants and agrees with said party of the first part to pay said party of the first part for said bulkhead at the rate of \$3.59 per lineal foot, and for said extra fastening to pay at the rate of \$1 65 for each six lineal feet of bulkhead when said extra fastening is put on.

Monthly estimates of the work done will be made by the engineer, and payment of ninety per cent of the contract-price will be made thereon, the remaining ten per cent to be retained until the completion, final measurement, and acceptance of the work.

It is agreed by and between the parties hereto, that upon all questions of measurement, lines, or grades, the decision of the engineer of said Board shall be final.

In testimony whereof the said F. G. Whitcomb has hereunto set his hand and seal, and the said Commonwealth has caused its seal to be hereto affixed, and these presents to be signed and delivered in its name and behalf by its Board of Harbor and Land Commissioners, the day and year above written, and the same to be approved by its Governor and Council.

F. G. WHITCOMB. [SEAL.]

THE COMMONWEALTH OF MASSACHUSETTS,

By ALBERT MASON,

[SEAL OF THE
COMMONWEALTH]

FRANCIS A. NYE,

HENRY L. WHITING,

Harbor and Land Commissioners.

IN COUNCIL, Sept. 20, 1881.

Approved.

HENRY B. PEIRCE, *Secretary.*

Recorded in vol. 2, Treaties, Contracts, etc., pp. 250-253.

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